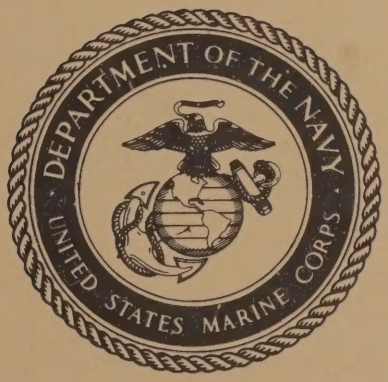
TM-07277A-12

U.S. MARINE CORPS TECHNICAL MANUAL

RADIO TERMINAL SETS
AN/TRC-166 AND AN/TRC-166 ( )

also PCC-1

OPERATION AND ORGANIZATIONAL MAINTENANCE



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21 May 1971

1. This Manual is effective upon receipt and provides information and instructions for the operation and organizational maintenance of Radio Terminal Sets, AN/TRC-166 and AN/TRC-166 ( ).

2. Notice of discrepancies and suggested changes to this Manual should be forwarded to the Commandant of the Marine Corps (Code CSY).

BY DIRECTION OF THE COMMANDANT OF THE MARINE CORPS

OFFICIAL

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RECORD OF CHANGES

CHANGE NO.	DATE ENTERED	TITLE OR BRIEF DESCRIPTION	ENTERED BY (SIG - RANK)

SAFETY SUMMARY

THIS MANUAL CONTAINS NO "WARNING" ITEMS; HOWEVER, ALL PERSONNEL SHOULD BECOME THOROUGHLY FAMILIAR WITH ALL ASPECTS OF SAFETY OF PERSONNEL AND EQUIPMENT PRIOR TO INSTALLATION, OPERATION AND MAINTENANCE OF ASSOCIATED EQUIPMENT.

CAUTIONS: (1) The equipment in its case is ruggedized and sturdy. When a case is removed for module changes, the chassis must be handled with care. Place the chassis on a flat surface to prevent perforation or damage to the cans or wiring. Keep the chassis clear of foreign matter (page 3-6).

(2) To avoid further trouble by mixing module locations, remove only one module at a time and replace it before removing a second module. As a module is replaced, always determine that the Z number on the top of the can corresponds with the Z number marked on the chassis (page 3-6).

(3) Under no circumstances are the factory-adjusted screws in the base of modules to be touched (page 3-6).

TABLE OF CONTENTS

PAGE

CHAPTER 1 GENERAL INFORMATION

PARAGRAPH

1-1 Introduction 1-1
1-2 Equipment Description, AN/TRC-166 and AN/TRC-166( ) Radio Terminal Sets 1-1
a. Terminal, Telegraph-Telephone, TH-81/GCC 1-1
b. Terminal Box, J-2790/GCC 1-1
c. Control Unit-Rectifier, C-7673/PCC-1 1-1
d. Cable Assembly, RF, CG-1773A/U 1-1
e. Cable Assembly, Special Purpose, Electrical, CX-10913/GCC 1-1
f. Cable Assembly, Power, Electrical, CX-10914/GCC 1-7
g. Cable Assembly, Special Purpose, Electrical, CX-12765/G 1-7
h. Cover, Battery Box, CW-996/PCC-1 1-7
i. Cover, Protective, CW-1024/PCC-1 1-7
j. Cover, Protective, CW-1030/PCC-1 1-9
k. Cover, Protective 1-9
l. Mount, MT-4056/PCC-1 1-9
m. Mount, MT-4057/PCC-1 1-9
n. Base, Antenna Support, AB-1135/PRC 1-9
o. Connector, Adapter, Electrical, UG-255A/U 1-9
1-3 Relationship of Units 1-9
a. Message Channels 1-12
b. Order-Wire Channel 1-12
c. Controls 1-12
1-4 Reference Data 1-12
a. Electrical Specifications 1-12
(1) Multiplex High Frequency 1-12
(2) Voice Frequency or Data Channels 1-12
(3) Order-Wire Channel 1-13
(4) Telegraph Channels 1-13
(5) Levels of VF Channels 1-13
(6) System Performance 1-14
(7) Power Data 1-14
b. Physical Data 1-14
(1) Environmental Operating Conditions 1-14
(2) Weight 1-14
(3) Dimensions 1-14

CHAPTER 2 OPERATION

2-1 Introduction 2-1
2-2 Service Requirements of Operator 2-1
2-3 Preparation for Use 2-1
a. Base Procedure 2-1
b. Before Deployment 2-1
c. Siting 2-1
d. Antenna Installation 2-1

TABLE OF CONTENTS (Continued)

PAGE

CHAPTER 2 OPERATION (Continued)

PARAGRAPH

2-4 Controls and Connectors 2-1
a. Terminal, Telegraph-Telephone, TH-81/GCC 2-3
b. Terminal Box, J-2790/GCC 2-3
c. Control Unit-Rectifier, C-7673/PCC 2-3
2-5 Operating Procedures 2-7
a. Condensed Operating Instructions 2-7
b. Radio Communication 2-7
c. Multiplex Communication 2-8
d. Local Communication 2-8
2-6 System Tests 2-9
a. Monitoring 2-9
b. Pilot Alarm 2-9
c. Local Test 2-9
d. Channel Priorities 2-9
2-7 Operating Under Unusual Conditions 2-9
a. General 2-10
b. Communication with a Radio Terminal Set, AN/MRC-134 2-10
c. Communication with a Radio Terminal Set, AN/GRC-163 2-10
d. Arctic Conditions 2-11
e. Tropical Conditions 2-11
f. Desert Conditions 2-11
2-8 Establishing Repeater Service 2-12
a. Repeater Equipment 2-12
b. Radio Operation 2-12
c. Multiplex Operation 2-12
d. Telephone Channel Connections 2-12
e. Order-Wire Connections 2-12
f. Telegraph Channel Connections 2-12
g. Local Service 2-14
2-9 Relocation 2-16

CHAPTER 3 MAINTENANCE (FIRST AND SECOND ECHELONS)

3-1 Introduction: Preventive/Scheduled Maintenance 3-1
3-2 Organizational Maintenance (First Echelon) 3-1
a. Maintenance Duties 3-1
b. Tools and Equipment 3-1
c. Terminal Set Transmission Functions 3-1
d. Multiplex Local Test 3-1
3-3 Organizational Maintenance (Second Echelon) 3-4
a. Level of Maintenance 3-4
b. Tools and Equipment 3-5
c. Telegraph Channels for Operation with Terminal, Telegraph-Telephone, TH-85/GCC 3-5
d. Telegraph Channels for Operation with Terminal, Telegraph, TH-5/TG or TH-22/TG 3-6
e. Cautions 3-6
f. Troubleshooting 3-6
(1) Symptom Recognition 3-6
(2) Localizing Trouble 3-6

TABLE OF CONTENTS (Continued)

PAGE

CHAPTER 3 MAINTENANCE (FIRST AND SECOND ECHELONS) (Continued)

PARAGRAPH

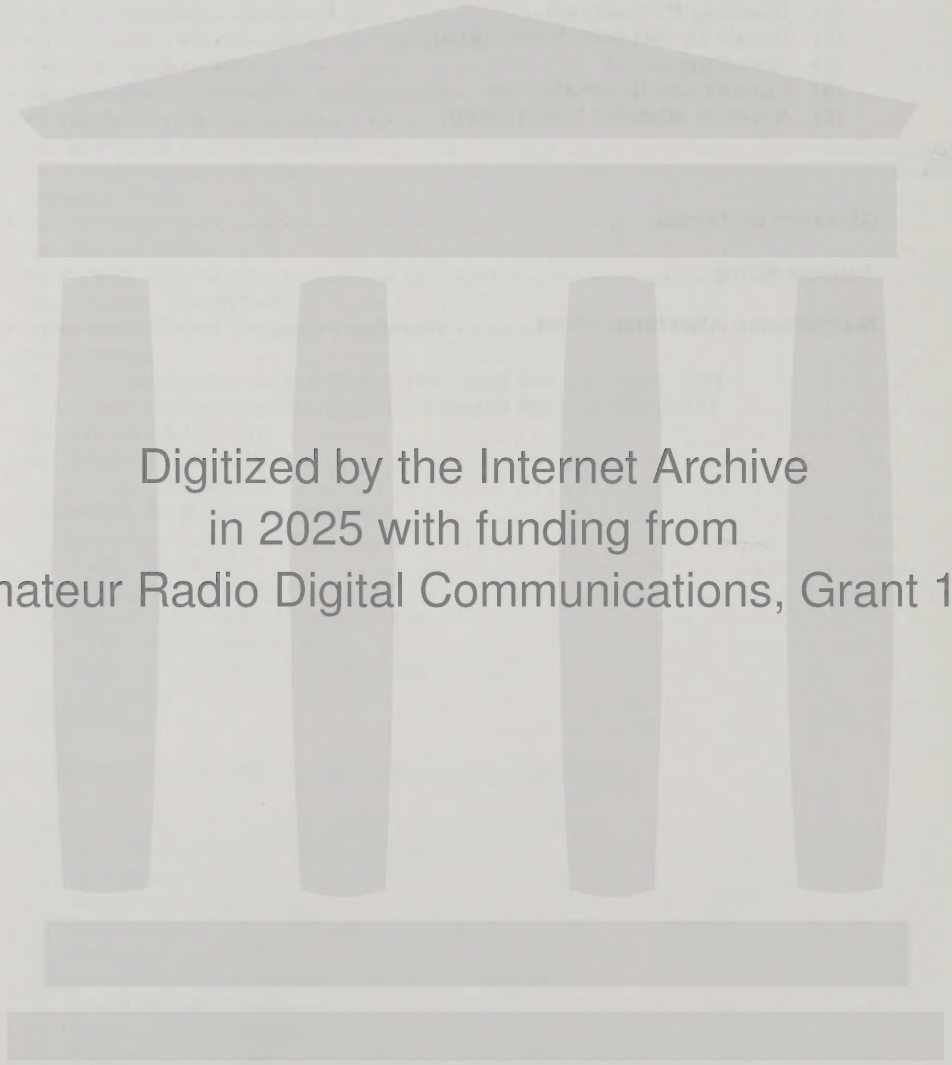
3-3 g. Repair Procedures 3-10
(1) Opening a Unit 3-10
(2) Handling Precautions 3-11
(3) Repair by Network Substitution 3-11
(4) Operating Check 3-13
(5) Closing and Reinstallation 3-13
(6) Network Modules Description 3-13

APPENDIX

A. Glossary of Terms A-1

B. Antenna Siting B-1

C. Maintenance Allocation Chart C-1



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LIST OF ILLUSTRATIONS

FIGURE	TITLE	PAGE
1-1	Terminal Set, AN/TRC-166 or AN/TRC-166( ), Radio Pack	viii
1-2	Terminal Set, AN/TRC-166 or AN/TRC-166( ), Multiplex Pack	ix
1-3	Terminal, Telegraph-Telephone, TH-81/GCC	1-4
1-4	Terminal Box, J-2790/GCC	1-5
1-5	Control Unit-Rectifier, C-7673/PCC-1	1-6
1-6	Cable Assembly, RF, CG-1773A/U	1-7
1-7	Cable Assembly, Special Purpose, Electrical, CX-10913/GCC	1-7
1-8	Cable Assembly, Power, Electrical, CX-10914/GCC	1-7
1-9	Cable Assembly, Special Purpose, Electrical, CX-12765/G	1-7
1-10	Cover, Battery Box, CW-996/PCC-1	1-8
1-11	Base, Antenna Support, AB-1135/PRC	1-9
1-12	Connector, Adapter, Electrical, UG-225A/U	1-9
1-13	Mount, MT-4056/PCC-1	1-10
1-14	Mount, MT-4057/PCC-1	1-11
2-1	Terminal Set, AN/TRC-166 or AN/TRC-166( ), Cabling Diagram	2-2
2-2	Terminal, Telegraph-Telephone, TH-81/GCC, Controls and Connectors	2-4
2-3	Terminal Box, J-2790/GCC, Connectors	2-4
2-4	Control Unit-Rectifier, C-7673/PCC-1, Controls and Connectors	2-6
2-5	Repeater Station, Block Diagram and Connections	2-13
2-6	Method of Retaining Cables, MUX Pack	2-14
2-7	Method of Retaining Cables, Radio Pack	2-14
2-8	Method of Mounting Bag, CW-503/PRC-25	2-15
3-1	System, Signal, Block Diagram	3-2
3-2	Terminal, Telegraph-Telephone, TH-81/GCC, Parts Location	3-7
3-3	Terminal, Telegraph-Telephone, TH-81/GCC, Removed From Case	3-10
3-4	Control Unit-Rectifier, C-7673/PCC-1, Parts Location	3-11
B-1	VHF Antenna Siting in Dense Woods	B-2
B-2	VHF Antenna Siting Near Woods	B-2
B-3	VHF Antenna Siting in Hilly Terrain	B-2

LIST OF TABLES

TABLE	TITLE	PAGE
1-1	Equipment List, Radio Terminal Sets, AN/TRC-166 and AN/TRC-166( )	1-2
1-2	Equipment List, Terminal Set, AN/PCC-1	1-3
2-1	Controls and Connectors Functions, Terminal, Telegraph-Telephone, TH-81/GCC	2-3
2-2	Controls and Connectors, Control Unit-Rectifier, C-7673/PCC-1	2-5
3-1	Signal Stages	3-3
3-2	Multiplex Local Test	3-5
3-3	Troubleshooting	3-8
3-4	Module Identification	3-12

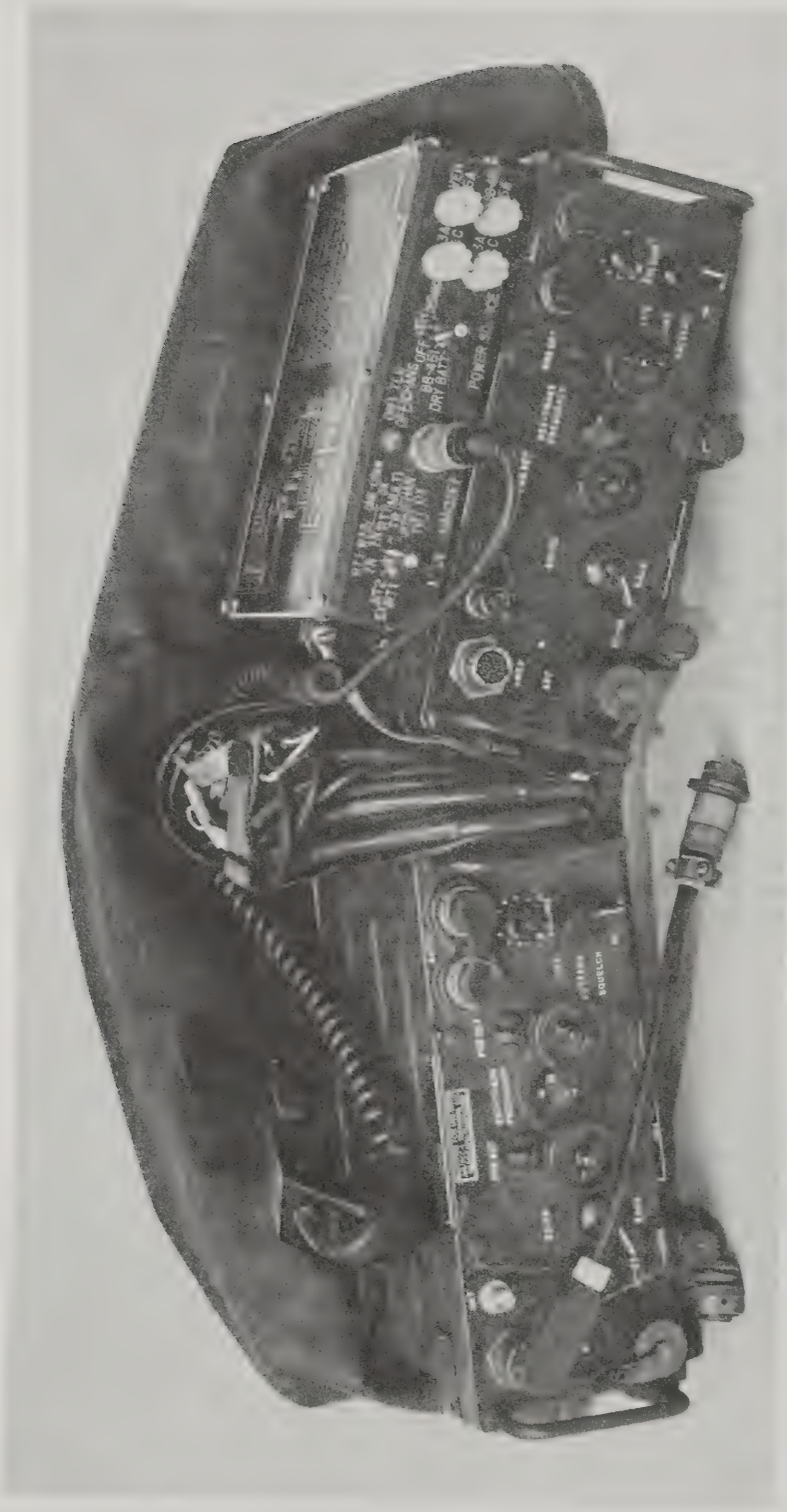


Figure 1-1. Terminal Set, AN/TRC-166 or AN/TRC-166( ), Radio Pack

Figure 1-2. Terminal Set, AN/TRC-166 or AN/TRC-166( ), Multiplex Pack

CHAPTER 1

GENERAL INFORMATION

1-1. INTRODUCTION. This manual describes the equipment, functions, operation and organizational maintenance of Terminal Sets, AN/TRC-166 and AN/TRC-166( ). Refer to the glossary of terms, Appendix A, for the explanation of unfamiliar terms used in this manual.

1-2. EQUIPMENT DESCRIPTION, AN/TRC-166 AND AN/TRC-166( ) RADIO TERMINAL SETS. The AN/TRC-166 or AN/TRC-166( ) Radio Terminal Set, hereinafter referred to as terminal set, is a two-rucksack-pack arrangement having two radio sets and a Terminal Set, Telegraph-Telephone, AN/PCC-1. It is used to provide a multichannel communication terminal of a radio link over which a number of messages can be sent and received simultaneously. The Radio Terminal Set, AN/TRC-166, consists of the combination of two modified Radio Sets, AN/PRC-25, plus one Terminal Set, Telegraph-Telephone, AN/PCC-1. Radio Terminal Set, AN/TRC-166( ), is a similar combination, but it uses two modified Radio Sets, AN/PRC-77, instead of the AN/PRC-25 Radio Sets. The equipment of a terminal set assembly is listed in table 1-1. Table 1-2 lists the equipment of an AN/PCC-1 Terminal Set which is item 1 in table 1-1. The AN/PCC-1 Terminal Set and the radio receiver-transmitters are assembled on two mounts for portability. The two radios and Control Unit-Rectifier, C-7673/PCC-1, are mounted on one mount (figure 1-1). The multiplex unit, TH-81/GCC; Battery, BB-451/U or BB-626/U, and Terminal Box, J-2790/GCC, are mounted on the second mount (figure 1-2). After the terminal set is positioned on site, radio communication is first established. Telephone and telegraph lines are connected to the local user's equipment when multiplex communication is established. The operating procedure is described in paragraph 2-5. The following paragraphs describe items of the terminal set which are not described in the radio technical manuals, item 16 of table 1-1.

a. TERMINAL, TELEGRAPH-TELEPHONE, TH-81/GCC (figure 1-3). This is a frequency-division carrier terminal designed to operate over a four-wire radio circuit or cable. It provides an order-wire, four telegraph and four telephone or data channels. Each telegraph channel operates over a two-wire, voice-frequency loop to a Terminal, Telegraph-Telephone, TH-85/GCC, at the teleprinter. Telegraph channels are compatible with Telegraph Terminals, TH-5/TG and TH-22/TG. The carrier terminal is a sealed, immersion-proof unit. All connectors and controls are located on the front panel. The chassis is mounted on the rear of the panel and is protected by a removable case. All circuitry, except the front panel connections and controls, is contained in sealed networks which plug into connectors on the chassis and are retained by mounting studs and nuts.

b. TERMINAL BOX, J-2790/GCC (figure 1-4). The terminal box has 24 binding posts and a cable with a 26-contact connector. It is used to connect the multiplexer to the voice-frequency loops of telephones and teletypewriters.

c. CONTROL UNIT-RECTIFIER, C-7673/PCC-1 (figure 1-5). This control unit is part of Terminal Set, AN/PCC-1. It supplies power to the radio sets and terminal from selected power sources. It also controls the mode of operation of the radio sets and the terminal. It is a sealed immersion-proof unit. Cables connect to the two radio receiver-transmitters to the multiplexer, external batteries, and ac power. A connector is provided for the Handset, H-189/PT. Fuses, a power-source switch, telegraph channel switch and a mode-of-operation switch are provided on the front panel.

d. CABLE ASSEMBLY, RF, CG-1773A/U (figure 1-6). This 25-foot coaxial cable assembly is used to connect RT-505B/PRC-25 or RT-841/PRC-77 Radio Receiver-Transmitter to an antenna. It forms part of the AN/PCC-1 Terminal Set.

e. CABLE ASSEMBLY, SPECIAL PURPOSE, ELECTRICAL, CX-10913/GCC (figure 1-7). This is a handset extension cable 50 feet long. It has a five-conductor connector on one end to connect to the Terminal, TH-81/GCC. The other end has a five-conductor connector for the handset and a push button for signaling the distant terminal set operator.

TABLE 1-1

EQUIPMENT LIST, RADIO TERMINAL SETS, AN/TRC-166 AND AN/TRC-166( )

Item	AN/TRC-166	AN/TRC-166( )	Qty. per set
1	Terminal Set, AN/PCC-1	Terminal Set, AN/PCC-1	1
2	Receiver-Transmitter, RT-505B/PRC-25	Receiver-Transmitter, RT-841/PRC-77	2
3	Handset, H-189/PT	Handset, H-189/PT	1
4	Antenna, AT-271A/PRC	Antenna, AT-271A/PRC	2
5	Antenna, AT-892/PRC-25	Antenna, AT-892/PRC-25	2
6	Antenna, AS-2236/	Antenna, AS-2236/	2
7	Bag, Cotton Duck, CW-503/PRC-25	Bag, Cotton Duck, CW-503/PRC-25	2
8	Billet, Straps	Billet, Straps	4
9	Support, Antenna AB-591/PRC-25	Support, Antenna AB-591/PRC-25	2
10	Support, Shoulder with 2 Crossbelts	Support, Shoulder with 2 Crossbelts	2
11	Battery, BB-451/U or BB-626/U	Battery, BB-451/U or BB-626/U	3 1
12	Battery, BA-386/PRC-25	Battery, BA-386/PRC-25	2
13	Support, Shoulder Strap	Support, Shoulder Strap	2
14	Rucksack Frame	Rucksack Frame	2
15	Waiststrap	Waiststrap	2
16	Technical Manual, TM 11-5820-398-12	Technical Manual, TM 11-5820-667-12	1

TABLE 1-2

EQUIPMENT LIST, TERMINAL SET, AN/PCC-1

Item	Nomenclature	Common Name	Fig.	Qty.
1	Terminal, Telegraph-Telephone, TH-81/GCC	Multiplexer	1-5	1
2	Terminal Box, J-2790/GCC	Terminal Box	1-6	1
3	Control Unit-Rectifier, C-7673/PCC-1	Control Unit	–	1
4	Cable Assembly, RF, CG-1773A/U (25 ft)	RF Cable	1-7	2
5	Cable Assembly, Special Purpose, Electrical, CX-10913/GCC (50 ft)	Handset Extension	1-8	1
6	Cable Assembly, Power, Electrical, CX-10914/GCC (50 ft)	Power Cable	1-9	1
7	Cable Assembly, Special Purpose, Electrical, CX-12765/G	RT-841 Adapter Cable	1-10	2
8	Cover, Battery Box, CW-996/PCC-1	Battery Cover	1-11	1
9	Cover, Protective, CW-1024/PCC-1	Mux Cover	–	1
10	Cover, Protective, CW-1030/PCC-1	Radio Cover	–	1
11	Cover, Protective	Terminal Box Cover	–	1
12	Mount, MT-4056/PCC-1	Mux Mount	–	1
13	Mount, MT-4057/PCC-1	Radio Mount	–	1
14	Base, Antenna, Support AB-1135/PRC	Antenna Base	1-12	2
15	Connector, Adapter, Electrical, UG-255A/U	Adapter Connector	–	2

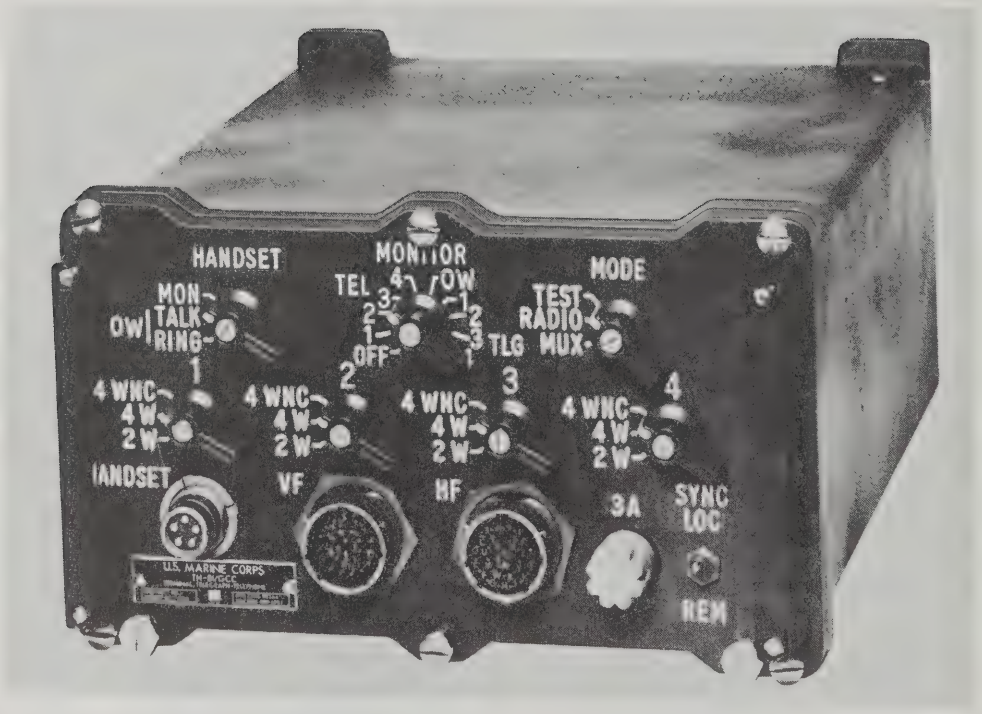


Figure 1-3. Terminal, Telegraph-Telephone, TH-81/GCC

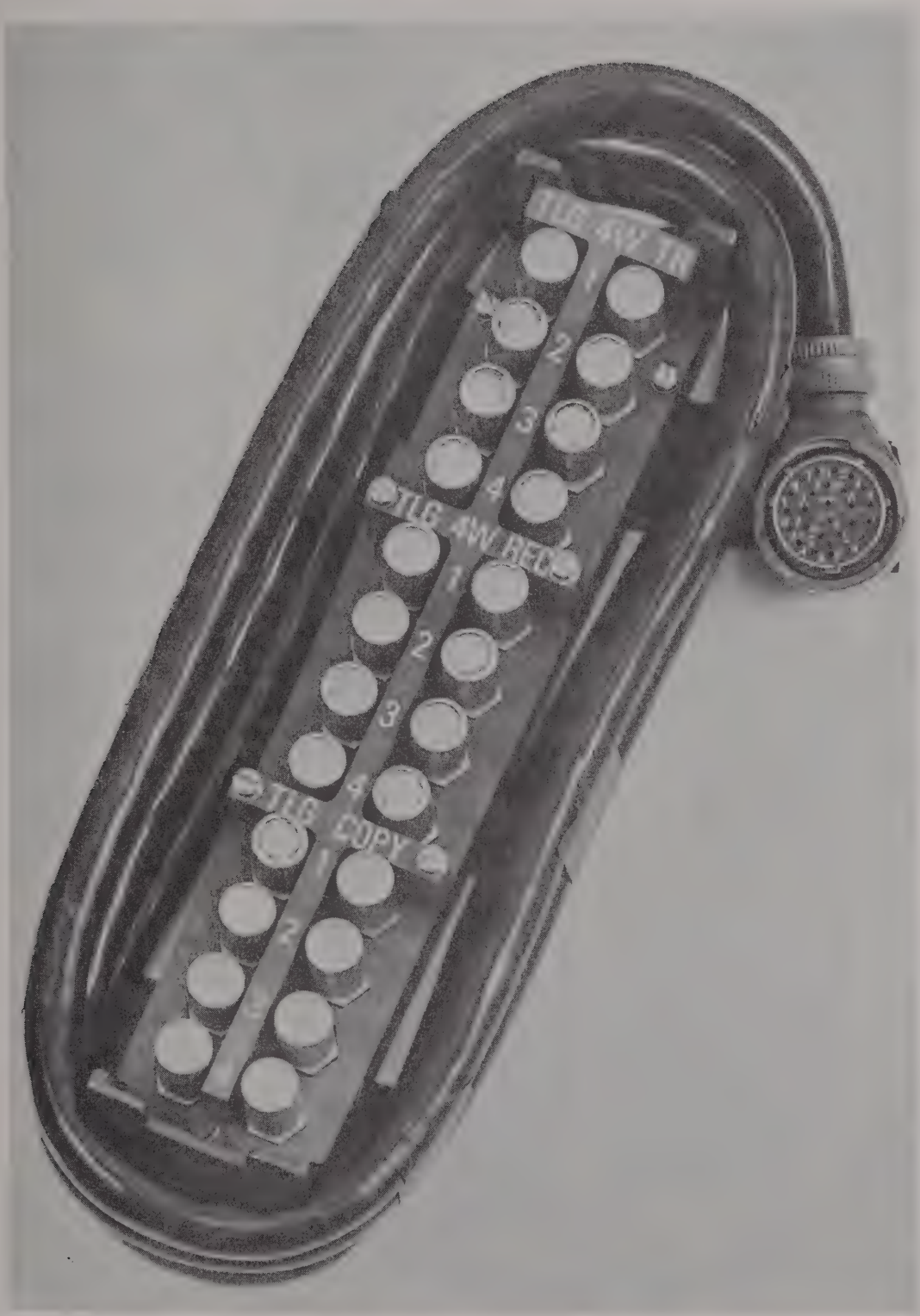


Figure 1-4. Terminal Box, J-2790/GCC

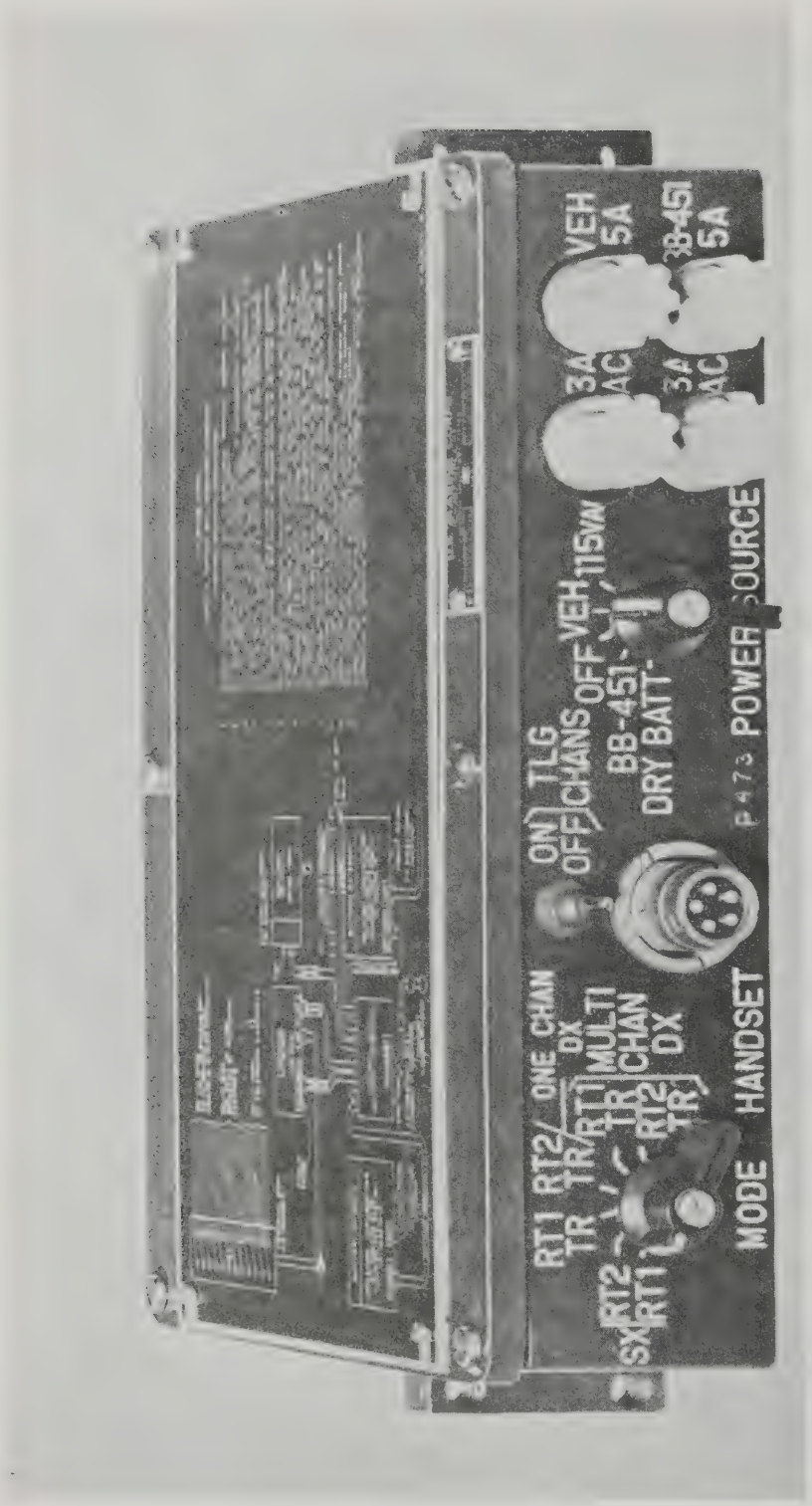


Figure 1-5. Control Unit-Rectifier, C-7673/PCC-1

Figure 1-6. Cable Assembly, RF, CG-1773A/U

f. CABLE ASSEMBLY, POWER, ELECTRICAL, CX-10914/GCC (figure 1-8). This is an ac power extension cable 50 feet long.

g. CABLE ASSEMBLY, SPECIAL PURPOSE, ELECTRICAL, CX-12765/G (figure 1-9). This cable is an adapter to connect between the power connection of an RT-841/PRC-77 and the connector plug of a captive power cable assembly from the Control Unit-Rectifier, C-7673/PCC-1.

h. COVER, BATTERY BOX, CW-996/PCC-1 (figure 1-10). This is a replacement cover for Battery, BB-451/U or BB-626/U, having a handle, and a five-conductor connector receptacle on top. It clamps to the battery.

i. COVER, PROTECTIVE, CW-1024/PCC-1. This cover is made of waterproof canvas. It is used to cover the multiplex and battery of the AN/PCC-1, and fastens to Mount, MT-4056/PCC-1, as shown in figure 1-2.

Figure 1-7. Cable Assembly, Special Purpose, Electrical CX-10913/GCC

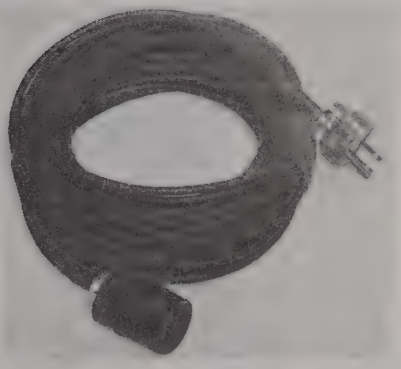


Figure 1-8. Cable Assembly, Power, Electrical, CX-10914/GCC

Figure 1-9. Cable Assembly, Special Purpose, Electrical, CX-12765/G

Figure 1-10. Cover, Battery Box, CW-996/PCC-1

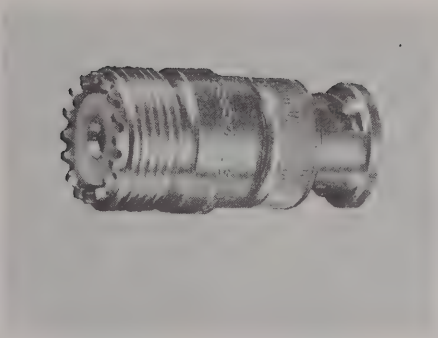


Figure 1-12. Connector, Adapter, Electrical, UG-255A/U

Figure 1-11. Base, Antenna Support, AB-1135/PRC

j. COVER, PROTECTIVE, CW-1030/PCC-1. This cover is made of waterproof canvas. It is used to cover the radio receiver-transmitters and the control unit of the AN/PCC-1, and fastens to Mount, MT-4057/PCC-1, as shown in figure 1-1.

k. COVER, PROTECTIVE. This cover is made of waterproof canvas. It is used to cover the Terminal Box, J-2790/GCC, of the AN/PCC-1 Terminal Set.

l. MOUNT, MT-4056/PCC-1 (figure 1-13). This mount is an aluminum frame arranged to be assembled onto a rucksack frame. It mounts the Battery, BB-451/U or BB-626/U, multiplex and terminal box.

m. MOUNT, MT-4057/PCC-1 (figure 1-14). This mount is an aluminum frame arranged to be assembled onto a rucksack frame. It mounts two Receiver-Transmitters, RT-505B/PRC-25 or RT-841/PRC-77, and a Control Unit-Rectifier, C-7673/PCC-1.

n. BASE, ANTENNA SUPPORT, AB-1135/PRC (figure 1-11). This base assembly consists of an aluminum alloy spike with an insulated threaded-mounting receptacle to support either an AT-892/PRC or an AT-271/PRC Antenna. A coaxial receptacle provides connection by cable to a radio receiver or transmitter.

o. CONNECTOR, ADAPTER, ELECTRICAL, UG-255A/U (figure 1-12). This connector has a type BNC connector at one end; the other end accepts a connector of antennas equipped with RG-8/U Cable.

1-3. RELATIONSHIP OF UNITS. The relative location of the units of the terminal set is shown in the cabling diagram (figure 2-1). The top three units of the diagram are mounted together as the MUX pack. The mechanical assembly of the MUX pack is shown in figure 2-6. Other

Figure 1-13. Mount, MT-4056/PCC-1

Figure 1-14. Mount, MT-4057/PCC-1

units shown in the cabling diagram are mounted together as the radio pack. The mechanical assembly of the radio pack is shown in figure 2-7.

a. MESSAGE CHANNELS. The terminal set provides for transmission and reception over a radio link of four channels of telephone or data messages and four channels of telegraph messages.

b. ORDER-WIRE CHANNEL. An order-wire channel is provided in the TH-81/GCC Terminal for the operator to communicate over the radio link, to monitor messages, and to test the operation of the terminal set.

c. CONTROLS. The Control Unit, C-7673/PCC-1, is arranged to operate the terminal set from any one of four sources of power. Two power sources are batteries contained in the terminal set. One is the radio batteries and the second is a BB-451/U or BB-626/U Storage Battery. A third power source may be from a vehicle and the fourth, from 115 volts, 50 to 420 Hertz. The control unit also arranges the terminal set to operate as a single-channel, push-to-talk radio link; a single-channel, simultaneous two-way radio link; or a multichannel, simultaneous two-way link. These arrangements are called modes of transmission. In case of a radio failure, the control unit can switch to the alternate receiver and transmitter of the terminal set for minimum loss of communication time.

1-4. REFERENCE DATA. The reference data of the AN/PCC-1 is given in the following paragraphs. Reference data for the radio sets is given in the technical manual for the radio set. (See item 16 of table 1-1.)

a. ELECTRICAL SPECIFICATIONS. The electrical specifications of the AN/PCC-1 are defined by the TH-81/GCC multiplex characteristics. These characteristics apply to the multiplex high frequency (MUX HF) signals connected through the control unit to the radio receiver and transmitter, and the voice-frequency (VF) signal channels at the terminal box connected to the user loops, and the handset order-wire channel. Use the term MUX HF when referring to the multiplexed channels signal to avoid confusion with the term HF used to describe radio signals.

(1) MULTIPLEX HIGH FREQUENCY

TERMINATION

Radio connections	Four-wire
Transmitting and receiving bandwidth	.3 to 19.7 kHz
Transmitting and receiving impedance	600 ohms

FREQUENCY ALLOCATIONS

CHANNEL OR FUNCTION	CARRIER FREQUENCY KHZ	FREQUENCY KHZ
Order-wire	none	0.3 to 2.1
Telegraph 1	4.0	2.725 midband
Telegraph 2	4.25	2.975 midband
Telegraph 3	4.5	3.225 midband
Telegraph 4	5.0	3.725 midband
Pilot	–	4.0
Telephone 1	8.0	4.5 to 7.7
Telephone 2	12.0	8.5 to 11.7
Telephone 3	16.0	12.5 to 15.7
Telephone 4	20.0	16.5 to 19.7

(2) VOICE FREQUENCY OR DATA CHANNELS

Number of voice frequency or data channels	Four
Bandpass of voice frequency	300 to 3,500 Hz
VF impedance of channels, balanced two-wire and four-wire	600 ohms
Type of modulation	Amplitude, single-sideband, carrier suppressed

Signaling frequency, two-wire vf loops	20 Hz
Signaling frequency, in band	1,600 Hz
Adjustments	None
Type of vf operation	
With 20 Hz signaling and compandor	Two-wire
Without 20 Hz signaling or compandor	Four-wire
Without 20 Hz signaling, with compandor	Four-wire
Limiting, two-wire	
Change of vf input level from -10 dBm to 0 dBm	0.4 dB Max.
Change of vf input level from -10 dBm to +15 dBm	7.0 dB Min.
Limiting, four-wire	
Change of vf input level from -14 dBm to -4 dBm	0.4 dB Max.
Change of vf input level from -14 dBm to +11 dBm	7.0 dB Min.

Compandor action	Input	Output
Compressor portion	-40 to 0 dBm	-22 to 0 dBm
Expandor portion	-22 to 0 dBm	-40 to 0 dBm

Channel frequency response relative to 1,000 Hz ± 1.0 dB

(3) ORDER-WIRE CHANNEL

Bandpass	300 to 2,100 Hz
Modulation	None
Ringing to distant terminal	1,600 Hz

(4) TELEGRAPH CHANNELS

Number of telegraph channels	Four
Bandpass of channel	145 Hz
Vf impedance of channels, balanced two-wire	600 ohms
Type of vf operation two-wire	NORMAL or TH-5/TH-22
Adjustments	none
Modulation	Frequency shift
Transmit frequency, normal, mark	1,317.5 Hz
TH-85/GCC space	1,232.5 Hz
Receive frequency, normal, mark	2,682.5 Hz
TH-85/GCC space	2,767.5 Hz
Receive frequency, mark	1,325 Hz
TH-5/TH-22 space	1,225 Hz
Channel frequency response relative to midband	±2 dB
Limiting; signals above -10 dBm limited to	-10 dBm Max.
Telegraph speed	75 bauds Max. (100 wpm)
Telegraph distortion at 75 bauds	3% Max.

(5) LEVELS OF VF CHANNELS

VF CHANNELS	CONDITION	SIGNAL	TRANSMIT	RECEIVE
Telephone	Two-wire	Test Tone	0 dBm	-3 dBm
Telephone	Four-wire	Test Tone	-4 dBm	-4 dBm
Telephone	Two-wire	20 Hz ring	60 volts into 5,000 ohms	12 volts minimum
Telegraph	Two-wire	Mark or Space	-9 to 0 dBm	-15 dBm

(6) SYSTEM PERFORMANCE. The system performance are those electrical characteristics which apply to two terminal sets operating over a radio link. These characteristics are:

Pilot regulation range for constant level test tone	-20 to +10 dBm
Pilot alarm sounds when attenuation between terminals is greater than:	22 dB
Vf to vf level change, four-wire for a ±10 dB change in HF attenuation	1.0 dB
Speech level, compandor accuracy	1.0 dB
Frequency error between terminals	
Order-wire	None
Telephone channels	None
Telegraph channels	None
Carrier leak per telephone channel, four-wire, no compandor	-20 dBm Max.
Noise, telephone channel, two-wire, F1A weighting, all channels idle	-50 dBm Max. (F1A)
Crosstalk, telephone channel to adjacent channel, two- or four-wire	-50 dBm Max. (F1A)
Crosstalk, near end, four-wire transmit to receive of a telephone channel	-50 dBm Max. (F1A)

(7) POWER DATA

Power requirements		22 to 35 volts dc
Power consumption, at 24 vdc	With Telegraph	Without Telegraph
Channels set to 4 WNC	9.4	6.2 watts
Channels set to 4 W	11.1	7.9 watts
Channels set to 2 W	11.4	8.2 watts

Battery Life: The duration of time for continuous operation of the AN/TRC-166 or AN/TRC-166( ) from batteries are:

BA-386 Dry Batteries	2 hours
BB-451 Battery, fully charged	18 hours

b. PHYSICAL DATA

(1) ENVIRONMENTAL OPERATING CONDITIONS

Altitude	Up to 50,000 feet
Relative humidity	100%
Temperature range, full performance	-40°F to 131°F
Temperature range, reduced performance	-67°F to 131°F
Temperature range, storage	-76°F to 131°F

(2) WEIGHT

		Weight
AN/TRC-166 or AN/TRC-166( )	Mux Pack	52 lbs
	Radio Pack	57 lbs

(3) DIMENSIONS

AN/TRC-166 or AN/TRC-166( ) (less rucksack frames)	Mux Pack	25"L x 12"W x 8"H
	Radio Pack	25"L x 12"W x 8"H

CHAPTER 2

OPERATION

2-1. INTRODUCTION. This chapter describes the detailed procedures to be used by the terminal set operator to set up and maintain good communications.

2-2. SERVICE REQUIREMENTS OF OPERATOR. Operation of a terminal requires proper siting, coordination of operation with a remote terminal set in one direction, and good wire service to the local area communication equipment. The operator is responsible for maintaining reliable service through the terminal set. After equipment is in operation, set up a schedule to monitor the channels (paragraph 2-6a). Regularly check all cables, connections and switches for damage or looseness. Maintain the equipment clean and sheltered from rain.

2-3. PREPARATION FOR USE. Unpack the equipment carefully. Check the contents against the lists of equipment, tables 1-1 and 1-2. Inspect the contents for damage. Report damage or shortages as prescribed in current Marine Corps directives. The following paragraphs provide information to prepare, test and plan before using the equipment on site.

a. BASE PROCEDURE. The terminal set operator must assure that the terminal set functions properly by performing an operational test at the base. Testing of the terminal set is required before going on a mission, after preparation for use, or when any part of the equipment has been removed and reinstalled. Connect cables according to figure 2-1 in preparation for an operational test. The method of testing a terminal set is to operate it with a second terminal set known to be in good operating condition and by following the routine described in paragraphs 2-5b and 2-5c. Should the radio or multiplex units fail in operation during a test, check the power source, fuses, cable connections and switch settings. If the failure cannot be corrected, request technical assistance.

NOTE

If Batteries, BA-386, are used as the power source for the terminal, ensure that fresh batteries are utilized before placing the terminal in operation. Have sufficient assets available to support the operation, as these batteries will give only 2 hours (approximately) of reliable power.

b. BEFORE DEPLOYMENT. Before deployment of terminal sets to communication sites, there are certain prerequisites. Obtain frequency assignments (paragraph 2-5b). Determine the proposed sites for setting up the terminal sets and estimate the time required to reach the sites and set up equipment so that a predetermined time for radio contact can be decided. Also predetermine which station or post is to be net control. After deployment of the terminal sets, radio contact is established and then multiplex communications are established as described in paragraphs 2-5b and 2-5c. When telegraph communication is planned, refer to paragraph 2-5d(4) for arrangement of telegraph channels in the multiplex unit to suit the conditions planned.

c. SITING. The operation of the Terminal Sets, AN/TRC-166 and AN/TRC-166( ), depends on good radio antenna siting. If a received radio signal is weak, radio noise will enter the multiplex receive circuits and cause telegraph or data errors and noisy telephone channels. Good siting for antennas is described in appendix B.

d. ANTENNA INSTALLATION. Whip antennas may be used when the distance and terrain permit a strong signal. Antenna Supports, AB-1135/PRC, and Cable Assembly, RF, CG-1773A/U (25 ft), are provided to place the antennas away from the terminal set. Directional antennas, when used, are installed in accordance with instructions provided in the technical manual for the directional antennas. Because both the receive and transmit antennas are operating continuously when in multiplex mode of transmission, the antennas must be separated as described in paragraph B-4 of appendix B.

2-4. CONTROLS AND CONNECTORS. The controls and connectors of the Terminal Set, AN/PCC-1, are described in the following paragraphs. The controls and connectors of the radio sets are described in the technical manual of the radio set supplied. (See item 16 of table 1-1.)

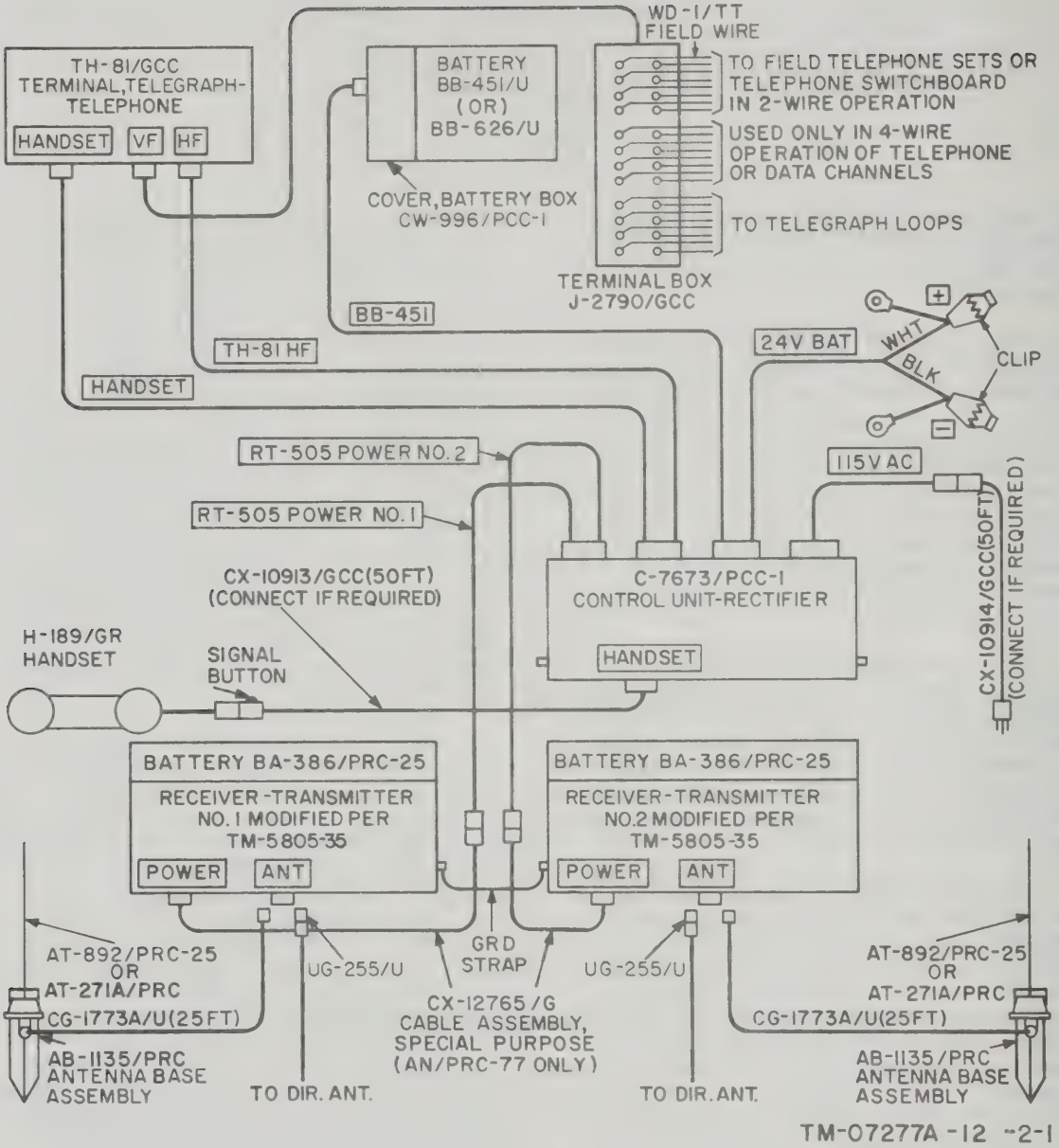


Figure 2-1. Terminal Set, AN/TRC-166 or AN/TRC-166( ), Cabling Diagram

TABLE 2-1

CONTROLS AND CONNECTORS FUNCTIONS, TERMINAL, TELEGRAPH-TELEPHONE, TH-81/GCC (Figure 2-2)

CONTROL OR CONNECTOR	SWITCH POSITION	FUNCTION
HANDSET switch (three-position rotary)	OW RING	Connects 1,600 Hz to the order-wire to signal the distant end.
	OW TALK	Connects the handset to the order-wire channel.
	MON	Connects the handset to the MONITOR switch.
MONITOR switch (ten-position rotary)	OFF	Disconnects handset from any channel.
	TEL 1, 2, 3, 4 or OW	Connects HANDSET switch to talk and listen on telephone channels or order-wire toward the distant terminal set.
	TLG 1, 2, 3, or 4	Connects HANDSET switch to listen on telegraph channels in both directions.
MODE switch (three-position rotary)	MUX	Connects the multiplex for normal operation.
	RADIO	Disconnects power from the multiplexer and connects the handset to the radio equipment (through the control unit).
	TEST	Connects the multiplex for operation except that it connects the HF output to the HF input and disconnects the HF from the radio receiver.
Channel 1, 2, 3 or 4, switches (three-position rotary)	2W	Arranges channel for operation two-wire vf, with compandor and 20-Hz ringing.
	4W	Arranges channel for operation four-wire vf, with compandor but no 20-Hz ringing.
	4WNC	Arranges channel for operation four-wire vf, without compandor or 20-Hz ringing.
HANDSET connector		Connects handset cable to multiplex.
VF connector		Connects terminal box to multiplex.
HF connector		Connects terminal to control unit or to group modem and connects power to multiplex.
Fuse (three ampere)		Protects power connections.
SYNC switch (two-position toggle)	LOC	Carrier supply and pilot signal controlled locally by crystal in multiplex.
	REM	Carrier supply and pilot signal synchronized to pilot frequency received from distant terminal set.

a. TERMINAL, TELEGRAPH-TELEPHONE, TH-81/GCC. The locations of the controls and connectors of the multiplex unit are shown in figure 2-2, and their functions are described in table 2-1.

b. TERMINAL BOX, J-2790/GCC. The location and functions of the terminal box connectors are shown in figure 2-3.

c. CONTROL UNIT-RECTIFIER, C-7673/PCC-1. The locations of controls and connectors of the control unit are shown in figure 2-4, and their functions are described in table 2-2.

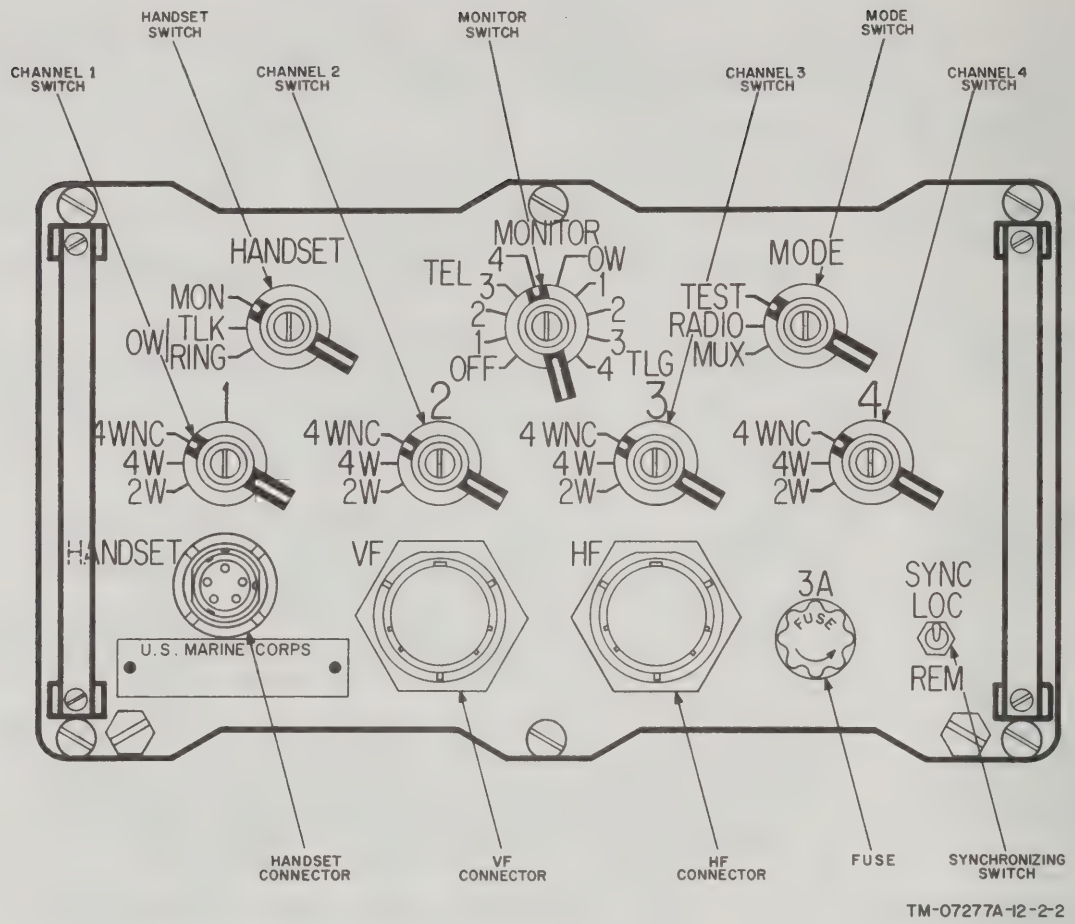


Figure 2-2. Terminal, Telegraph-Telephone, TH-81/GCC, Controls and Connectors

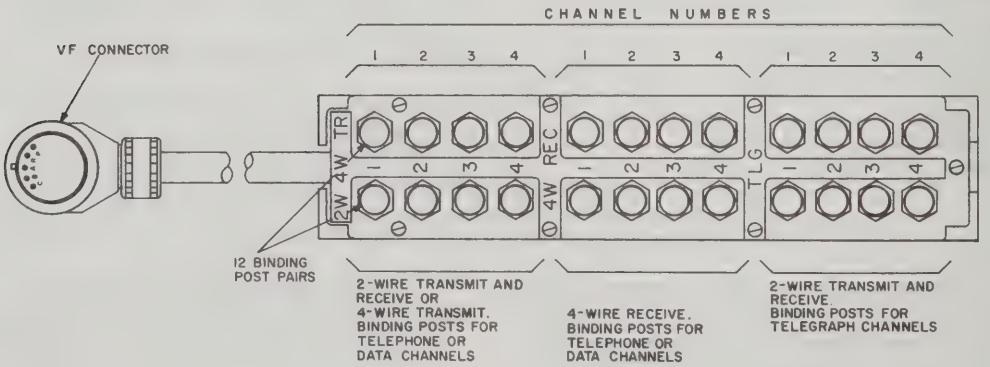


Figure 2-3. Terminal Box, J-2790/GCC, Connectors

TABLE 2-2

CONTROLS AND CONNECTORS, CONTROL UNIT RECTIFIER, C-7673/PCC-1

CONTROL OR CONNECTOR	SWITCH POSITION	FUNCTION
MODE switch (six-position rotary)	SX RT 1	Connects the handset and power to receiver-transmitter No. 1.
	SX RT 2	Connects the handset and power to receiver-transmitter No. 2
	ONE CHAN DX RT 1 TR	Connects the handset microphone to the transmitter of RT No. 1 and the receiver of the handset to RT No. 2 and holds RT 1 on transmit.
	ONE CHAN DX RT 2 TR	Connects the handset microphone to the transmitter of RT No. 2 and the receiver of the handset to RT No. 1 and holds RT 2 on transmit.
	MULTI CHAN DX RT 1 TR	Connects the HF transmit output of the multiplex to the transmitter of RT No. 1 and the output of the receiver of RT No. 2 to the HF receiving input of the multiplex; connects the handset to the multiplex through its HANDSET connector; holds RT 1 on transmit.
	MULTI CHAN DX RT 2 TR	Connects the HF transmit output of the multiplex to the transmitter of RT No. 2 and the output of the receiver of RT No. 1 to the HF receiving input of the multiplex; connects the handset to the multiplex through its HANDSET connector; holds RT 2 on transmit.
TLG CHANS switch (two-position toggle)	ON	Connects power to the telegraph circuits of the multiplex.
	OFF	Removes power from the telegraph circuits of the multiplex.
HANDSET connector		Provides connection for the handset.
POWER SOURCE switch (five-position rotary)	DRY BATT	Connects the BA-386/U Batteries in the battery boxes of the receiver-transmitters to the receiver-transmitters and to the voltage doubler to supply the multiplex.
	BB-451	Connects the BB-451/U or BB-626/U Battery to the multiplex and to the voltage divider to supply the receiver-transmitters.
	OFF	Disconnects all power.
	VEH	Connects the vehicle battery to the multiplex and to the voltage divider to supply the receiver-transmitters.
	115 VAC	Connects 115 volts ac to the rectifiers to provide power to the receiver-transmitters and the multiplex.

TABLE 2-2 (Continued)

CONTROLS AND CONNECTORS, CONTROL UNIT RECTIFIER, C-7673/PCC-1

CONTROL OR CONNECTOR	SWITCH POSITION	FUNCTION
115 VAC fuses 3A AC (three ampere)		Protects the ac connections.
VEH 5A fuse (five ampere)		Protects the connection from the vehicle battery.
BB-451 5A fuse (five ampere)		Protects the connection from Battery, BB-451/U or BB-626/U.

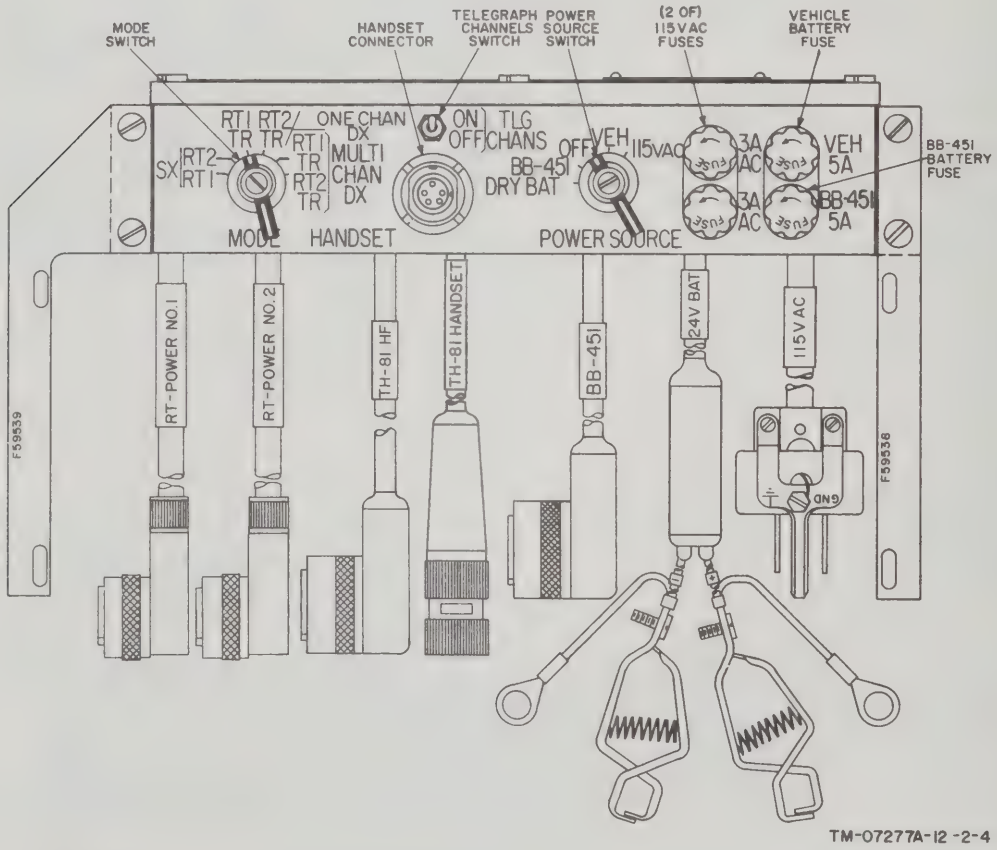


Figure 2-4. Control Unit-Rectifier, C-7673/PCC-1, Controls and Connectors

2-5. OPERATING PROCEDURES. Before operating procedures are followed, the equipment must be prepared for use by planning and testing according to paragraphs 2-3a through 2-3d. The following operating instructions provide step-by-step procedures to establish communications under normal conditions. Instructions for establishing communications under conditions other than normal are given in paragraph 2-7.

a. CONDENSED OPERATING INSTRUCTIONS. Condensed operating instructions and cable connecting information for the terminal set are given on a plate permanently attached to the top of the control unit. More detailed instructions follow in paragraphs 2-5b, c, and d.

b. RADIO COMMUNICATION. Predetermine one radio frequency (Freq. 1) and time of contact with which communications are to be established. Four frequencies should be assigned to an installation. Two frequencies, Freq. 1 and Freq. 2, for prime use; and two frequencies, Freq. 3 and Freq. 4, for alternate use. The following instructions apply to both ends of the radio link except where instructions are described for net control and station. If at any point in the list of instructions, radio contact is lost, return to the last point of contact to check reason for loss of contact. When an AN/TRC-166 or AN/TRC-166( ) is communicating with a Radio Terminal Set, AN/MRC-134, AN/MRC-135, or AN/GRC-163, or ship-installed terminal set, refer to instruction notes, paragraphs 2-7b or 2-7c.

(1) Install antennas as directed. When two antennas are used, they must be separated by a minimum of 25 feet. When a whip antenna is mounted on one of the radio receiver-transmitters, the radio and control unit assembly is turned so the antenna is vertical.

(2) Connect Handset, H-189/GR, to the RT 1 right-hand AUDIO connector.

(3) Connect cables, except handset and TH-81 Handset Cable, according to cabling diagram (figure 2-1).

(4) Set RT 1 BAND switch to the range in which the predetermined Freq. 1 is located.

(5) Set RT 1 REC-TRANS FREQUENCY to Freq. 1.

(6) Set RT 1 VOLUME control to 8.

(7) Set lower right switch of RT 1 to ON.

(8) Set POWER SOURCE switch of the C-7673/PCC control unit to the position indicating the power source being used. Sound will be heard in the handset receiver.

(9) If sound is not heard, check cable connections, fuses and power source. Request technical assistance if trouble is not found, and proceed with steps (3) through (8), using receiver-transmitter number two (RT 2) to establish contact at predetermined time.

(10) If sound is heard, transmit by operating the handset press-to-talk switch to contact distant radio operator.

(11) After radio contact is established, set RT 1 VOLUME control to a maximum volume level.

(12) Coordinate with the distant operator to establish simplex and duplex single channel radio communication through the AN/PCC-1 terminal set as follows:

(13) Set controls on the TH-81/GCC as follows:

HANDSET switch to OW/TALK
MONITOR switch to OFF
MODE switch to RADIO
Chan 1 switch to 2W
Chan 2 switch to 2W
Chan 3 switch to 2W
Chan 4 switch to 2W
Net Control, SYNC switch to LOC
Station, SYNC switch to REM

(14) Set controls on the C-7673/PCC control unit as follows:

MODE switch to SX/RT 1
TLG CHANS switch to OFF

(15) Check through list with distant operator to ensure that all controls are set correctly; then, transfer the handset connector from HANDSET connector of RT 1 to the HANDSET connector of the C-7673/PCC control unit and check the transfer of the handset connector by talking with the distant operator.

(16) Set RT 2 BAND switch to the range in which Freq. 2 is located.

(17) Set RT 2 REC-TRANS FREQUENCY to Freq. 2.

(18) Set RT 2 VOLUME control to 8.

(19) Talk with the distant operator to check the RT 2 settings.

(20) Change the MODE switch of the C-7673/PCC control unit to SX/RT 2, and talk with distant operator.

(21) Set RT 2 VOLUME control to a maximum volume level.

(22) Net control sets C-7673/PCC MODE switch to DX/RT 1 TR and station sets C-7673/PCC MODE switch to DX/RT 2 TR. Talk with the distant radio operator to check these settings.

(23) Net control sets C-7673/PCC MODE switch to DX/RT 2 TR and station sets C-7673/PCC MODE switch to DX/RT 1 TR. Talk with the distant radio operator to check these settings.

(24) This completes establishment of radio SX and DX communications.

c. MULTIPLEX COMMUNICATION. After single channel duplex radio communication has been established (paragraphs 2-5b(1) through (24)), multichannel operation can be set up and tested by coordinating with the distant terminal operator.

(1) Set MODE switch on TH-81/GCC terminal to MUX; at net control terminal set, set MODE switch of C-7673/PCC Control to MULTI CHAN DX/RT 1 and, at the station terminal, set MODE switch of C-7673/PCC Control to MULTI CHAN DX/RT 2 TR. Talk to distant terminal operator to check these settings.

(2) At net control terminal, change setting of MODE switch of C-7673/PCC Control to MULTI CHAN DX/RT 2 and, at station terminal, set MODE switch of C-7673/PCC Control to MULTI CHAN DX/RT 1 TR. Talk to distant terminal operator to check these settings.

(3) Communication is now through the multiplex order-wire channel of the net control terminal set and the station terminal set, using the station transmitter of RT 1 and station receiver of RT 2, and the net control transmitter of RT 2 and net control receiver of RT 1. The station receiver of RT 1 and transmitter of RT 2, and the net control receiver of RT 2 and transmitter of RT 1 are standby and may be used, if required, by setting the MODE switches of the C-7673/PCC Controls to RT 2 at the station terminal and RT 1 TR at net control terminal.

(4) Proceed, as described in the following, by conversation with the distant terminal operator to check out the voice channels by talking through the monitor circuits over the telephone channels of the TH-81/GCC Terminal.

(5) Set the HANDSET switch to MON and MONITOR switch to TEL 1. Talk to the distant terminal operator on channel 1 with channel 1 switch set to 2W, 4W and 4WNC in turn. Return channel 1 switch to 2W. Set MONITOR switch to TEL 2. Talk on channel 2, using 2W, 4W and 4WNC, in turn. Return channel 2 switch to 2W. Repeat procedure on channels 3 and 4. Set MONITOR switch to OW to complete voice channels check.

(6) Monitor the four telegraph channels by setting the TLG CHANS switch of the C-7673/PCC Control Unit to ON. Steady double tones will be heard when setting the MONITOR switch to TLG 1, 2, 3 and 4. Return the TLG CHANS switch on C-7673/PCC Control Unit of OFF after monitoring the telegraph channels.

(7) Return MONITOR switch to OFF and HANDSET switch to OW/TALK. Talk to distant terminal operator to check control settings.

(8) Test ringing to distant terminal operator by momentarily setting the HANDSET switch to OW/RING to call the distant terminal operator. He, in turn, makes similar ringing test.

(9) This completes establishment and test of multiplex communication between terminal sets.

d. LOCAL COMMUNICATION. Local services of telegraph, telephone or data equipment can be connected after multiplex communications are established. The following paragraphs provide instructions for these connections.

(1) Two-wire field telephones or field switchboards are connected by WD-1/TT wire to the J-2790/GCC Terminal Box at terminals marked 2W 4WTR (figure 2-3). As connections are made to the terminal box, set the multiplex channel switch 1, 2, 3 or 4 to 2W. Contact the distant terminal operator and advise the specific local service and telephone channel number connected.

(2) Equipment of local services which require four-wire connections are connected to the terminal box with transmit loop to 2W 4WTR and the receive loop to 4W REC. Set the channel switches to 4W for voice service or 4WNC for data service.

(3) Local telegraph services are two-wire vf signals from Telegraph-Telephone Terminals, TH-85/GCC, TH-5/TG, or TH-22/TG, and are connected to the J-2790/GCC Terminal Box telegraph channel terminals TLG 1, 2, 3 or 4. When telegraph transmission is not being used the TLG switch on the Control Unit-Rectifier is set to OFF to conserve battery power. When telegraph equipment is connected and in use, this TLG switch is set to ON. Contact the distant terminal operator and advise the specific local services and telegraph channel number connected.

(4) When the local telegraph service originates from TH-85/GCC Telegraph Terminals, the telegraph channels in the TH-81/GCC operate in what is called NORMAL condition. When the local telegraph service originates from either TH-5/TG or TH-22/TG, the telegraph channels in the TH-81/GCC Terminal operate in what is called TH-5 condition. Request technical assistance before deployment of terminal set to arrange telegraph channels to suit the equipment to be connected. Technicians should refer to maintenance paragraphs 3-3c and 4 for instructions on telegraph arrangements.

2-6. SYSTEM TESTS. After multiplex communications have been established (paragraph 2-5c) and local services have been connected (paragraph 2-5d), a schedule to test the system by monitoring channels at regular intervals is required. The terminal operators, having direct contact on the order-wire channel, can test channels which are not in use by talking over the channels using the monitoring procedures. Loss of multiplex signals is indicated by a pilot alarm which alerts the operator to test for the cause of lost signals.

a. MONITORING. An operating system must be regularly checked by monitoring the channels. Maintain a schedule to monitor all channels. Schedule for frequent monitoring after the communicating system is first established. The frequency of monitoring may be reduced when operation has normalized. Monitoring consists of listening to sounds of speech, data or tones of channels in the TH-81/GCC multiplex. Refer to paragraphs 2-5c(4) through (7) for the monitoring procedure with the distant operator to test channels which are not in use.

b. PILOT ALARM. The pilot alarm at the local terminal will sound when losses of HF signal in the transmission path between terminal sets becomes excessive, and also when signal is lost by disconnection, distant transmitter malfunction or local receiver malfunction. The sound of the pilot alarm is a two-tone signal from the handset receiver. If this alarm is heard for a short time and stops, it indicates temporary loss of radio signal. If the alarm persists, check for signal from local radio receiver by setting TH-81/GCC multiplex MODE switch to RADIO and listen for signal or noise. If signal is heard, the receiver volume control is not set to maximum or the trouble is the local multiplex. If noise is heard, return the MODE switch to MUX and set the HANDSET switch to OW/RING for a few seconds to call the distant operator. Set the HANDSET switch to TALK; listen for the operator. If the operator cannot be heard, repeat the call procedure until sure that distant operator cannot respond. Set MODE switch to RADIO and reestablish radio contact with the distant station.

c. LOCAL TEST. Local test of the multiplex unit is provided to self-test the transmit-and-receive path of each channel. This test, when performed, will show whether the transmit-and-receive paths of a channel in the multiplex are operating properly. If operation is found to be normal, the trouble is external to the multiplex unit. A connected loop circuit may be at fault due to a short or open circuit. Local test is described under multiplex local test procedure, paragraph 3-2d.

d. CHANNEL PRIORITIES. Local services using channels of the terminal set have assigned priorities of importance. The operator must observe which channels carry the priority services. In the event that a priority service channel fails and the terminal set loops are not connected to a switchboard the priority service should be transferred without delay to a serviceable channel at the terminal box. Advise the distant operator of the proposed transfer before making the transfer in order that the priority service can be properly addressed at the distant terminal set.

2-7. OPERATING UNDER UNUSUAL CONDITIONS. Unusual conditions for operation of the terminal set occur when operating with a distant terminal set which is not an AN/TRC-166, using AN/TRC-166 Terminal Sets as a repeater station or operating the terminal set in extreme weather conditions.

a. GENERAL. The operation of equipment may be different in regions where extreme cold, heat, humidity, dust, dirt and sand prevail. Observe the applicable precautions given in paragraph 2-7d, e, or f to provide the best protection of equipment possible. Operation of the terminal set to communicate with a distant terminal set which has AN/VRC-12 type radio sets requires the modified radio communication procedures given in paragraph 2-7b or 2-7c.

b. COMMUNICATION WITH A RADIO TERMINAL SET, AN/MRC-134. When a Terminal Set, AN/TRC-166 or AN/TRC-166( ), is to communicate with a Terminal Set, AN/MRS-134, which has equivalent radio frequencies and channel capacities, the coordinated actions to be taken by the AN/MRC-134 distant operator with the instructions of paragraph 2-5b are as follows:

(1) At instructions (4) and (5) of paragraph 2-5b, distant operator sets the MODE switch of the C-7827/VCC Control Unit to SIMPLEX and sets the RT-524/VRC Receiver-Transmitter to Freq. 1.

(2) At instruction (20), change the RT-524/VRC Receiver-Transmitter to Freq. 2.

(3) At instruction (22), set the MODE switch of the C-7827/VCC Control Unit to SINGLE CHANNEL DUPLEX, and set frequencies to correspond to one of terminal set conditions as follows:

(a) Terminal set is station, and C-7673/PCC MODE switch is set to DX/RT 2 TR	AN/MRC-134 is net control. Set the R-442 Receiver to Freq. 2. Set the RT-524 Receiver-Transmitter to Freq. 1.
(b) Terminal set is net control, and C-7673/PCC MODE switch is set to DX/RT 1 TR	AN/MRC-134 is station. Set the R-442 Receiver to Freq. 1. Set the RT-524 Receiver-Transmitter to Freq. 2.

(4) Talk with distant operator to check settings.

(5) At instruction (23), change frequencies to correspond to one of terminal set conditions as follows:

(a) Terminal set is station, C-7673/PCC MODE switch set to DX/RT 1 TR	AN/MRC-134 is net control. Set the R-442 Receiver to Freq. 1. Set the RT-524 Receiver-Transmitter to Freq. 2.
(b) Terminal set is net control, and C-7673/PCC MODE switch is set to DX/RT 2 TR	AN/MRC-134 is station. Set the R-442 Receiver to Freq. 2. Set the RT-524 Receiver-Transmitter to Freq. 1.

(6) Talk with the distant operator to check settings.

(7) This completes establishment of single-channel duplex radio communication between the AN/TRC-166 Terminal Set and an AN/MRC-134 Terminal Set.

(8) Multichannel duplex operation can be established after single-channel duplex radio communication has been established by setting the MODE switch of the C-7827/VCC Control Unit to MULTICHANNEL DUPLEX. Set the frequencies of the R-442/VRC Radio Receiver and RT-524/VRC Receiver-Transmitter to correspond to one of the MODE switch conditions of the Control Unit-Rectifier, C-7673/PCC, as decided and described in paragraph 2-7b(3)(a) or (b), or 2-7b(5)(a) or (b).

c. COMMUNICATION WITH A RADIO TERMINAL SET, AN/GRC-163. When a Radio Terminal Set, AN/TRC-166 or AN/TRC-166( ), is to communicate with a Radio Terminal Set, AN/GRC-163, which has equivalent radio frequencies, the coordinated actions to be taken by the distant operator of the AN/GRC-163, with the instructions of paragraph 2-5b, to establish duplex radio communication are as follows:

(1) At instructions (4) and (5) of paragraph 2-5b, the distant operator sets the HANDSET switch of the Multiplexer, TD-856(P)/TCC, to

RADIO and sets the Receiver-Transmitter, RT-524/VRC, to Freq. 1.

(2) At instruction (20), change the Receiver-Transmitter, RT-524/VRC, to Freq. 2.

(3) At instruction (22), set the handset switch of the Multiplexer, TD-856(P)/TCC, to MUX, and set radio frequencies to correspond to AN/TRC-166 Terminal Set conditions as follows:

(a) Terminal set is station, and C-7673/PCC MODE switch is set to DX/RT 2 TR	AN/GRC-163 is net control. Set the R-442 Receiver to Freq. 2. Set the RT-524 Receiver-Transmitter to Freq. 1.
(b) Terminal set is net control, and C-7673/PCC MODE switch is set to DX/RT 1 TR	AN/GRC-163 is station. Set the R-442 Receiver to Freq. 1. Set the RT-524 Receiver-Transmitter to Freq. 2.

(4) Talk with distant operator to check settings.

(5) At instruction (23), change frequencies to correspond to AN/TRC-166 Terminal Set conditions as follows:

(a) Terminal set is station, C-7673/PCC MODE switch set to DX/RT 1 TR	AN/GRC-163 is net control. Set the R-442 Receiver to Freq. 1. Set the RT-524 Receiver-Transmitter to Freq. 2.
(b) Terminal set is net control, and C-7673/PCC MODE switch is set to DX/RT 2 TR	AN/GRC-163 is station. Set the R-442 Receiver to Freq. 2. Set the RT-524 Receiver-Transmitter to Freq. 1.

(6) Talk with the distant operator to check settings.

(7) This completes establishment of single-channel duplex radio communication between the AN/TRC-166 Terminal Set and an AN/GRC-163 Terminal Set.

(8) Multichannel duplex operation can be established after single-channel duplex radio communication has been established by leaving the HANDSET switch of the Multiplexer, TD-856(P)/TCC, set at MUX. Set the frequencies of the R-442/VRC Radio Receiver and RT-524/VRC Receiver-Transmitter to correspond to one of the MODE switch conditions of the Control Unit-Rectifier, C-7673/PCC, as decided and described in paragraph 2-7c(3)(a) or (b) or 2-7c(5)(a) or (b).

NOTE

When monitoring telegraph channels (paragraph 2-5c(6)), the Radio Terminal Set, AN/GRC-163, normally has only two telegraph channels.

d. ARCTIC CONDITIONS

(1) Extreme cold may cause brittleness of wires connected to the terminal sets. Use care in handling and connecting so that sharp bending of the brittle cables will not cause damage to the cables.

(2) Keep the terminal sets as warm and dry as possible.

(3) When a terminal set that has been exposed to the cold is brought into a warm or sheltered area, moisture will gather on the panel and terminal box. Dry the equipment thoroughly to remove the moisture.

e. TROPICAL CONDITIONS. When the equipment is operated in the tropics, or when it is set up in swampy areas in the tropics, adverse moisture, heat, and ventilation conditions are more acute than normal. To minimize the accumulation of moisture and excessive heating, provide the best shelter and ventilation possible.

f. DESERT CONDITIONS. The amount of dust, dirt and sand that collects in the connectors, and the overheating of equipment, are the main problems of equipment operation in the desert. Be sure to keep the terminal set as free from

dust, dirt, and sand as possible, and maintain good ventilation.

2-8. ESTABLISHING REPEATER SERVICE (figure 2-5). Repeater service is the retransmission of duplex signals by a repeater station placed between terminal sets which are separated by a distance too great for dependable radio transmission. The repeater station converts the received signal to vf channels through a multiplex unit and then, by connection of the vf channel loops to a second multiplex unit, the channels are recombined for retransmission. All vf channels appear at the multiplex terminal boxes where channels can be interconnected for retransmission or be connected to operate vf equipment local to the repeater station.

a. REPEATER EQUIPMENT. For repeater service, two AN/TRC-166 or AN/TRC-166( ) Radio Terminal Sets are required to make a repeater station assembly. Each terminal set is connected according to cabling diagram (figure 2-1). The terminal sets are arranged to operate in a system as shown in block diagram (figure 2-5). The terminal sets on either side of the repeater station are respectively referred to as west terminal and east terminal to distinguish between the directions of signal retransmission at the repeater station.

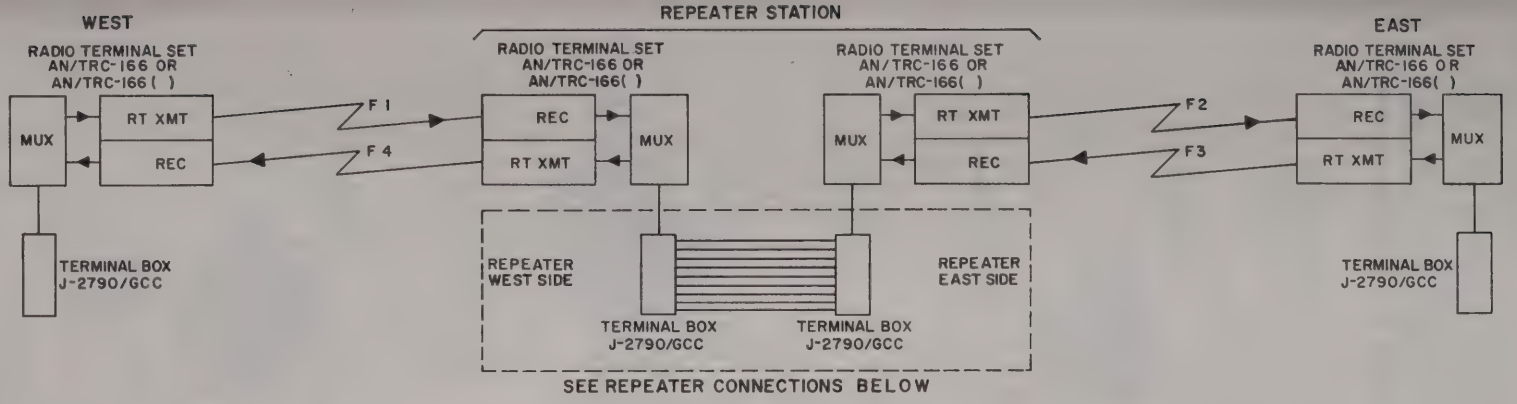
b. RADIO OPERATION. For repeater service, four receiver-transmitters are required to provide simultaneous, continuous operation of one receiver and one transmitter in one direction (east), while another receiver and transmitter operate in a reverse direction (west). Four noninterfering radio frequencies (No's. 1, 2, 3 and 4) and the time of contact are decided before deployment of the terminals and repeater station. Transmission from the west terminal to the repeater station and from the repeater station to the east terminal uses radio frequencies No's. 1 and 2. In the direction from the east terminal through the repeater station to the west terminal, radio frequencies No's. 3 and 4 are used. Establishment of radio communication between the west side of the repeater station and the west terminal is performed first, according to paragraphs 2-5b(1) through (24). After duplex contact is made to the west terminal, establish duplex radio contact between the east side of the repeater station and the east terminal.

c. MULTIPLEX OPERATION. After duplex radio communications have been established west and east, proceed to establish and test multiplex communication functions to the west terminal, according to paragraphs 2-5c(1) through (9). After west multiplex is established, establish and test multiplex communication functions to the east terminal.

d. TELEPHONE CHANNEL CONNECTIONS (figure 2-5). Connect the corresponding channels from the west terminal to channels from the east terminal at the repeater station Terminal Boxes, J-2790/GCC. Use 2-foot lengths of WD-1/TT field wire to close the repeater connections from the west to east sides. The telephone channels are connected four-wire to four-wire and the channel switches of both multiplexers are set to 4W. The 2W 4WTR terminal pairs 1, 2, 3 and 4 of the repeater west side terminal box are connected to the 4W REC terminal pairs 1, 2, 3 and 4 of the east side terminal box for west-to-east retransmission. The 2W 4WTR terminal pairs 1, 2, 3 and 4 of the repeater east side terminal box are connected to the 4W REC terminal pairs of the west side terminal box for east-to-west retransmission. This completes the telephone channel connections for repeater service.

e. ORDER-WIRE CONNECTIONS. The order-wire channel of the west and east terminals terminate at the west and east sides of the repeater station. Through connection of the west terminal operator and east terminal operator is made by connecting a field telephone set to one of the voice channels at the west terminal and one at the same channel of the east terminal. The west and east terminal operators can speak on any channel through the monitoring procedure, but signaling between terminal operators requires the use of field telephones.

f. TELEGRAPH CHANNEL CONNECTIONS (figure 2-5). Telegraph communication through the repeater station can be provided only if the telegraph channels of the east and west multiplexers and the repeater multiplexers are arranged for half duplex operation (see paragraph 3-3d). The half duplex mode of operation will provide matching mark and space frequencies suitable for retransmission. Where doubt exists, request technical assistance. If the telegraph signals are suitable for retransmission, connect the corresponding numbered pair of TLG terminals 1, 2, 3 and 4 of J-2790/GCC Terminal Box (west side of repeater), to TLG terminal pairs 1, 2, 3 and 4 of the east side of repeater. This completes the telegraph channel connections for west-to-east and east-to-west retransmission. When telegraph channels are not used, set the TLG CHANS switches on both C-7673/PCC-1 Control Units to OFF to conserve power.



NOTES

1. FOR LOCAL SERVICE CONNECT LOCAL LINE 2W OR 4W TO CHANNEL REQUIRED. REMOVE CONNECTION OF CHANNEL BETWEEN TERMINAL BOXES.
2. DOTTED LINES SHOW EXAMPLE OF INTERCONNECTIONS TO BE REMOVED WHEN A CHANNEL IS USED FOR LOCAL SERVICE.

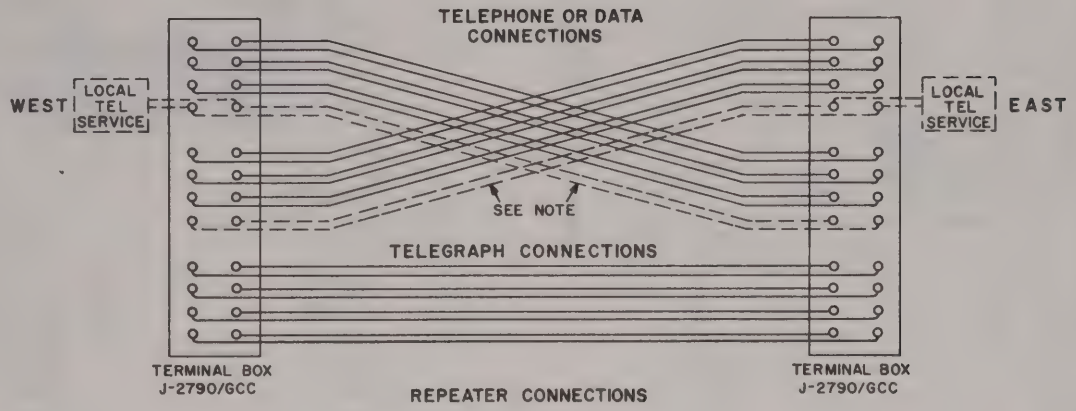


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Figure 2-5. Repeater Station, Block Diagram and Connections

b. LOCAL SERVICE. When a repeater station is required to provide wire service to equipment located at or near the locality of the repeater station, the east or west channel required for this service is connected to the local equipment loop at the terminal box. The corresponding channel number on the other side of the repeater cannot be used for retransmission, but may be used for local service equipment to that side. Figure 2-5 shows an example of alternate connections for retransmission or local service on channel 4 east and west for field telephone sets.

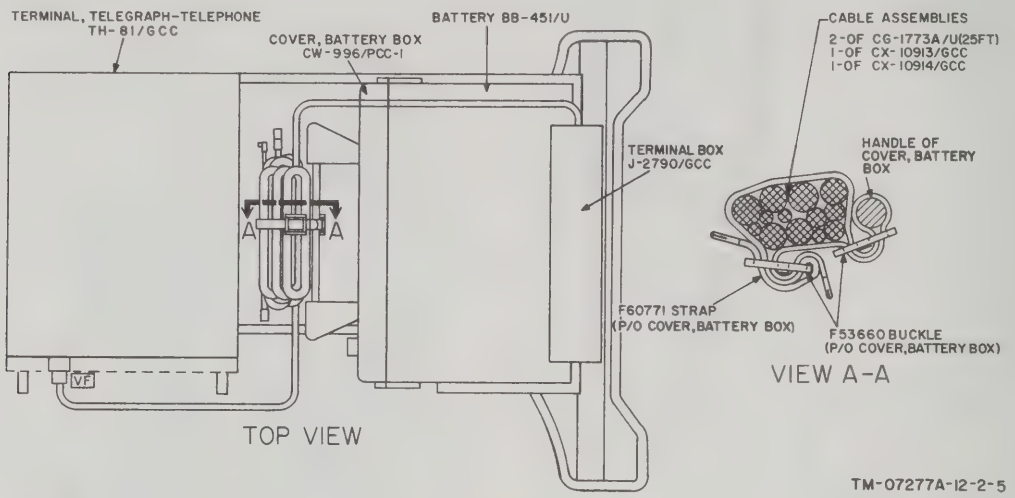


Figure 2-6. Method of Retaining Cables, MUX Pack

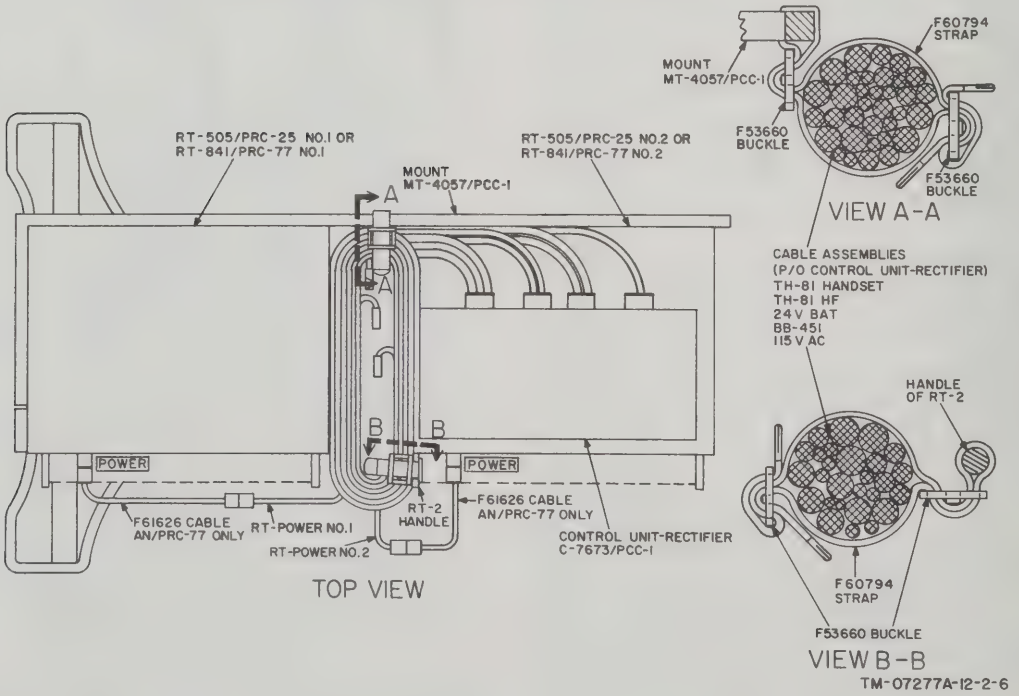


Figure 2-7. Method of Retaining Cables, Radio Pack

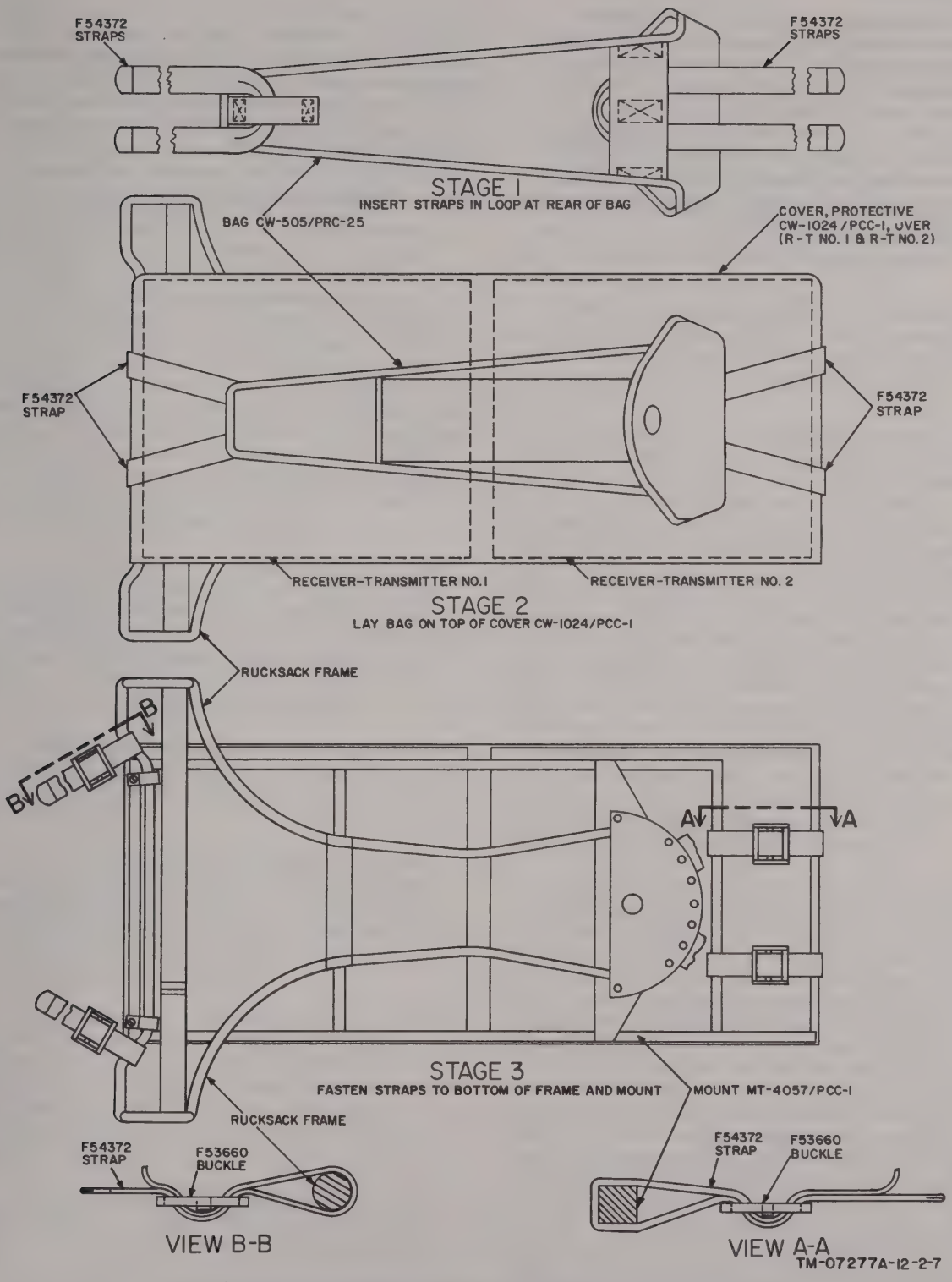


Figure 2-8. Method of Mounting Bag, CW-503/PRC-25

When a telephone set is connected, the dotted cross-connecting pairs between terminal boxes are left unconnected. The channel 4 switch of the multiplex unit to which the telephone set is connected is set to 2W. When a channel is used for local service, that channel is equivalent to a terminal set channel and is connected to equipment according to paragraph 2-5d. Monitoring and test of the local service channel is performed according to paragraph 2-6a.

2-9. RELOCATION. In the event that a terminal set requires relocating, plan for the new site in advance. Predetermine with the distant operator the time and radio frequency for radio contact at the new site. Advise the distant operator of the new site grid location to enable him to realign the radio directional antennas he may be using. Refer to figures 2-6, 2-7 and 2-8 for details to retain cables and antennas during transport.

CHAPTER 3

MAINTENANCE (FIRST AND SECOND ECHELONS)

3-1. INTRODUCTION: PREVENTIVE/ SCHEDULED MAINTENANCE. Maintenance of the terminal set is a combination of radio set maintenance and Terminal Set, AN/PCC-1, maintenance. Faults are localized to either radio or multiplex malfunction by the operation tests of the terminal set. Maintenance of the radio sets is covered in the radio set technical manual (item 16 of table 1-1). Multiplex and control unit faults are located by troubleshooting tables. Circuit faults are corrected by replacing the network module containing the fault with a spare plug-in module. No special tools or test equipment are required for maintenance or repair at the organizational level.

3-2. ORGANIZATIONAL MAINTENANCE (FIRST ECHELON). First echelon maintenance is that maintenance performed by the user or operator of the terminal set, in providing the proper care, use, operation, cleaning, preservation, minor repair, and parts replacement, as prescribed by this and other pertinent publications.

a. MAINTENANCE DUTIES. To maintain the equipment in good operating condition, the operator's duties, after establishing communications, are as follows:

(1) Perform routine preventive maintenance by systematic care, servicing and inspection of the equipment. This is to prevent the occurrence of trouble, to reduce downtime, and to assure that the equipment is serviceable. Maintain the equipment clean.

(2) Inspect the equipment daily for possible causes of communication failure. Causes of failure can be cables or wire connections which are subject to handling or traffic damage. Accumulations of moisture and dirt could cause trouble. Check the power sources for possible cause of failure.

(3) maintain a log of operation times on battery power so battery replacement can be made in advance of its power termination point.

(4) Regular monitoring is required to assure that all channels are operating properly. (See paragraph 2-6a.)

(5) If trouble is experienced and cannot quickly be located and corrected, request technical assistance for an electrical test, correction, or float replacement.

b. TOOLS AND EQUIPMENT. All connections are to spring binding posts. A wire skinning tool and side cutting pliers are required for preparation of field wires to be connected. Fuses are manually replaced.

c. TERMINAL SET TRANSMISSION FUNCTIONS. The transmission functions of the terminal set must be known by the operator to understand the monitoring and testing procedures. The functions of the terminal set in a communication system are shown in the system, signal, block diagram (figure 3-1). In figure 3-1, the signal of one telephone channel is traced through the system of two terminal sets from the local terminal box to the distant terminal box and back. The signal is traced in stages through the transmit side of the channel and back through the receive side of the same channel in the terminal set. The circled numbers shown in figure 3-1 illustrate the stages through which the channel signal passes. The numbered stages are described in table 3-1. All channels, telephone or data and telegraph, follow a similar path separately and in parallel through the system.

d. MULTIPLEX LOCAL TEST. The multiplex unit has provision to perform a local test of all channels. The local test is made by setting the MODE switch to TEST. This switch position disconnects all channels from the radio set to perform a test of the transmit-and-receive paths of each channel connected together at the HF end of the multiplex. (See stages 4a(c) and 12a(c) of table 3-1.) When this test is required, all channels of communication are interrupted; therefore, the test must be performed quickly and preferably at a time when all channels are clear of communication signals. Before performing the test, notify the distant operator to stand by for a specified length of time to carry out the test procedure. Testing of four telephone and four telegraph channels will require less than 2 minutes. Table 3-2 describes the step-by-step procedure for local test of the multiplex. Test results which are not normal indicate trouble within the multiplex unit. Request technical assistance.

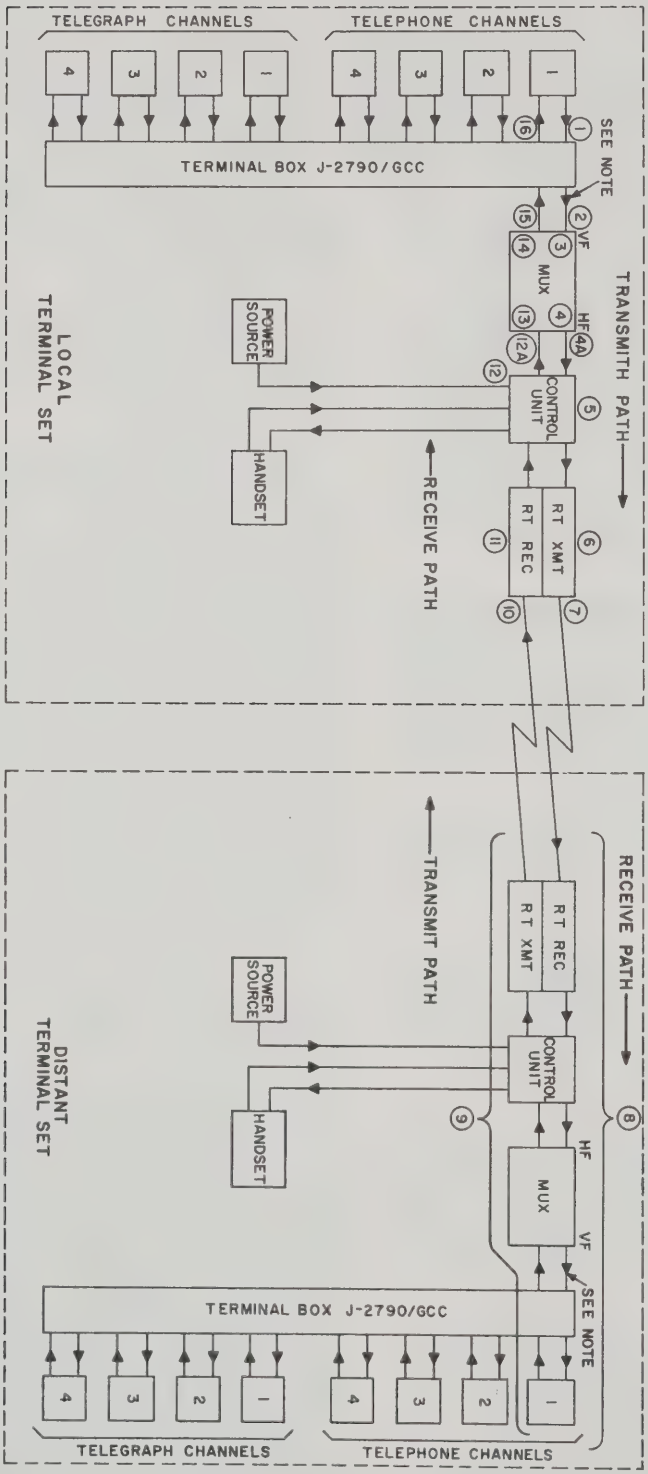


Figure 3-1. System, Signal, Block Diagram

NOTE:
CHANNEL 1 ONLY OF THE 8 CHANNELS CONNECTED BY CABLE TO MUX IS SHOWN.

TM-07277A-12-3-1

TABLE 3-1

SIGNAL STAGES (Figure 3-1)

	STAGE	
LOCAL TRANSMIT STAGES	1.	Local telephone or data transmitter connected to a channel at the terminal box 2W 4WTR. (See notes at end of table.)
	2.	Transmit side of VF channel enters multiplex.
	3.	Monitor point of channel signal being transmitted and point at which operator's microphone is connected when monitoring a channel.
	4.	HF transmit side of multiplex after channels have been combined in the multiplex unit.
	4a.	Stage at which the combined channels, HF signal, is switched by MODE switch to: (a) MUX. Connects mux xmt to radio xmtr through control unit. Connects handset transmitter to order-wire channel. (b) RADIO. Disconnects mux xmt from control unit and radio xmtr and puts handset transmitter onto radio xmtr for radio operation without multiplex. (c) TEST. Connects mux xmt HF output 4A to mux rec input 12A; disconnects mux from radio receiver. Connects handset transmitter to order-wire channel for local test.
	5.	Combined channels pass through control unit without change.
	6.	Combined channels modulate radio frequency and are transmitted to distant terminal set.
	7.	Local terminal set transmit antenna.
DISTANT TERMINAL SET	8.	Distant terminal set receives HF multiplex signal and converts channels to VF receive signals for distant user's equipment. Stage 8 has the same stages as 10 through 16 of the local terminal set receive path.
	9.	Distant terminal set VF signals from user's equipment transmitters are combined into HF multiplex signals for radio transmission. Stage 9 has the same stages as stages 1 through 7 of the local terminal set transmit path.
LOCAL RECEIVE STAGES	10.	Local terminal set radio receiver antenna.
	11.	Combined channels are received and demodulated from radio frequency for the receive path of the mux.
	12.	Combined channels pass through control unit without change.

TABLE 3-1 (Continued)

SIGNAL STAGES (Figure 3-1)

	STAGE	
LOCAL RECEIVE STAGES	12a.	Stage at which the local HF signal is switched by MODE switch to: (a) MUX. Connects combined signal received to the receive side of the mux. Connects handset receiver to order-wire channel. (b) RADIO. Disconnects combined signals from the radio receiver and connects handset receiver to radio receiver for radio operation without multiplex. (c) TEST. Connects mux receive HF input 12A to local xmt HF output 4A. Disconnects mux from radio receiver. Connects handset receiver to order-wire channel for local test.
	13.	Combined channels are amplified and divided into separate VF channels.
	14.	Separate VF channel for connection to terminal box.
	15.	Monitor point of channel signal being received and point at which operator's handset receiver is connected when monitoring a channel.
	16.	Local telephone or data receiver connected to a channel at the terminal box 4W REC. (See notes at end of table.)

NOTES

1. In order to simplify tracing, the signal is traced as a four-wire telephone channel with the local loops connected to the terminal box 2W 4WTR pair and 4W REC pair. The multiplex channel switch is set to 4W.

2. When a two-wire telephone loop is connected to the 2W 4WTR pair on the terminal box, the multiplex channel switch is set to 2W. This switch setting connects a hybrid circuit into the loop end of the channel to separate the transmit path (stage 2) from the receive path (stage 15).

3. Telegraph loops are two-wire and connect into a hybrid circuit for separation of transmit and receive paths.

4. Explanatory terms used in description of signal stages are defined in glossary of terms, appendix A.

3-3. ORGANIZATIONAL MAINTENANCE (SECOND ECHELON). Second echelon maintenance is the work designated to be performed by specially trained personnel provided for that purpose in the using organization. Maintenance will be as prescribed in this and other pertinent publications and will be consistent with allowances of tools, test equipment, necessary parts, and supplies, and the availability of skilled personnel to perform maintenance beyond the capabilities and facilities of the first echelon.

a. LEVEL OF MAINTENANCE. The degree of maintenance required of the technician is to troubleshoot problems in the radio and multiplex equipment. Troubleshooting will be confined to checking local loops and power supplies and replacement of equipment modules. No adjustments

TABLE 3-2

MULTIPLEX LOCAL TEST (Paragraph 3-2c)

ITEM	CONTROL	ACTION
1	SYNC switch	Set to LOC.
2	Channel switches 1 through 4	Set each to 4W.
3	MODE switch	Set to TEST.
4	MONITOR switch	Set to OFF.
5	HANDSET switch	Set to OW/TALK. Press switch on handset and blow into microphone. Loud sound is heard in receiver if OW chan is normal.
6	HANDSET switch	Set to MON.
7	MONITOR switch	Set to TEL/1. Press switch on handset and blow into microphone. Loud sound is heard in receiver if chan 1 is normal.
8	MONITOR switch	Repeat item 7 for TEL/2, 3 and 4, in turn.
9	MONITOR switch	Set to TLG/1. A loud low-frequency tone and a weak high-frequency tone is heard in the receiver if the channel is normal.
10.	MONITOR switch	Repeat item 9 for TLG/2, 3 and 4, in turn. The lower frequency tone will be higher at each setting of MONITOR switch.
11	MONITOR	Set to OFF; test is completed.
12	HANDSET switch	Set to TALK.
13	MODE switch	Reset to MUX or RADIO as before test.
14	Channel switches 1 through 4	Reset to 2W, 4W or 4WNC as before test.
15	SYNC switch	Reset to LOC or REM as before test.

are to be made on the equipment. Maintenance and repair of radio sets will be accomplished according to TM 11-5820-398-12 for the AN/PRC-25 Radio Set, or TM 11-5820-667-12 for the AN/PRC-77 Radio Set. Maintenance and repair of the TH-81/GCC Terminal Set and the C-7673/PCC-1 Control Unit will be restricted to information provided in this technical manual.

b. TOOLS AND EQUIPMENT. Tools and test equipment requirements for the multiplex and control unit are:

1 Screwdriver, 3/8", flat blade

1 Screwdriver, 3/16", flat blade

1 Multimeter, TS-297 (FSN 6625-649-5223) or equivalent

The multimeter is required for voltage and continuity measurements external to the multiplex and control unit.

c. TELEGRAPH CHANNELS FOR OPERATION WITH TERMINAL, TELEGRAPH-TELEPHONE,

TH-85/GCC. The Terminal, Telegraph-Telephone, TH-81/GCC, has four channels of telegraph which can each operate on the voice frequency two-wire loop side in duplex mode to a Terminal, Telegraph-Telephone, TH-85/GCC, to provide teletypewriter service. Four network modules (Z3, Z7, Z14 and Z15) are originally installed in the multiplex to operate in a "Normal" mode with TH-85/GCC Telegraph Terminals; these modules are mounted on the chassis in connectors marked XZ3B, XZ7B, XZ14B and XZ15B. (See figure 3-2.) The letter "N" for normal operation is visible through oblong holes in the chassis at the end of these module connectors. Whichever of the four telegraph channels are to be used with TH-85/GCC Terminals, the network modules must be positioned on the chassis with the letter N showing. Z3 is telegraph channel 1, Z7 is channel 2, Z14 is channel 3, and Z15 is channel 4.

d. TELEGRAPH CHANNELS FOR OPERATION WITH TERMINAL, TELEGRAPH, TH-5/TG or TH-22/TG. When any one or more of the four telegraph channels of the multiplex is to be used with a TH-5/TG or TH-22/TG Telegraph Terminal connected to a channel loop, the circuit will operate in a half-duplex mode and the telegraph channel network modules Z3, Z7, Z14 or Z15 must be positioned on the chassis connectors so that a figure 5 for TH-5 is visible through the oblong holes. (See paragraph 3-3c.) The modules plug into the XZ3A, XZ7A, XZ14A and XZ15A chassis connectors (figure 3-2) for operation with TH-5/TG or TH-22/TG Telegraph Terminals.

e. CAUTIONS. When the multiplex units are opened, these cautions are to be observed.

(1) The equipment in its case is ruggedized and sturdy. When a case is removed from module changes, the chassis must be handled with care. Place the chassis on a flat surface to prevent perforation or damage to the module cans or wiring. Keep the chassis clear of foreign matter.

(2) To avoid further trouble by mixing module locations, remove only one module at a time and replace it before removing a second module. As a module is replaced, always determine that the Z number on the top of the can corresponds with the Z number marked on the chassis.

(3) Under no circumstances are the factory-adjusted screws in the base of modules to be touched.

f. TROUBLESHOOTING. Troubles in the operation of the terminal set can be located by the use of troubleshooting information provided in table 3-3. The table is arranged into categories and subdivisions of trouble symptoms observed by the operators when monitoring and testing.

(1) SYMPTOM RECOGNITION. Before opening the multiplex or control unit, determine the trouble symptom. First check for obvious faults, such as defective fuses, inadequate power supply, loose cords, switches set incorrectly, and loop connections short or open. Paragraph 3-3f(2), together with table 3-3, provide guidance for localizing the trouble for correction when the symptom is known. Trouble in one channel does not affect other channels. Trouble in circuits common to channels affect those channels sharing the common circuit. Radio transmitter or receiver malfunctions affect transmission or reception on all channels.

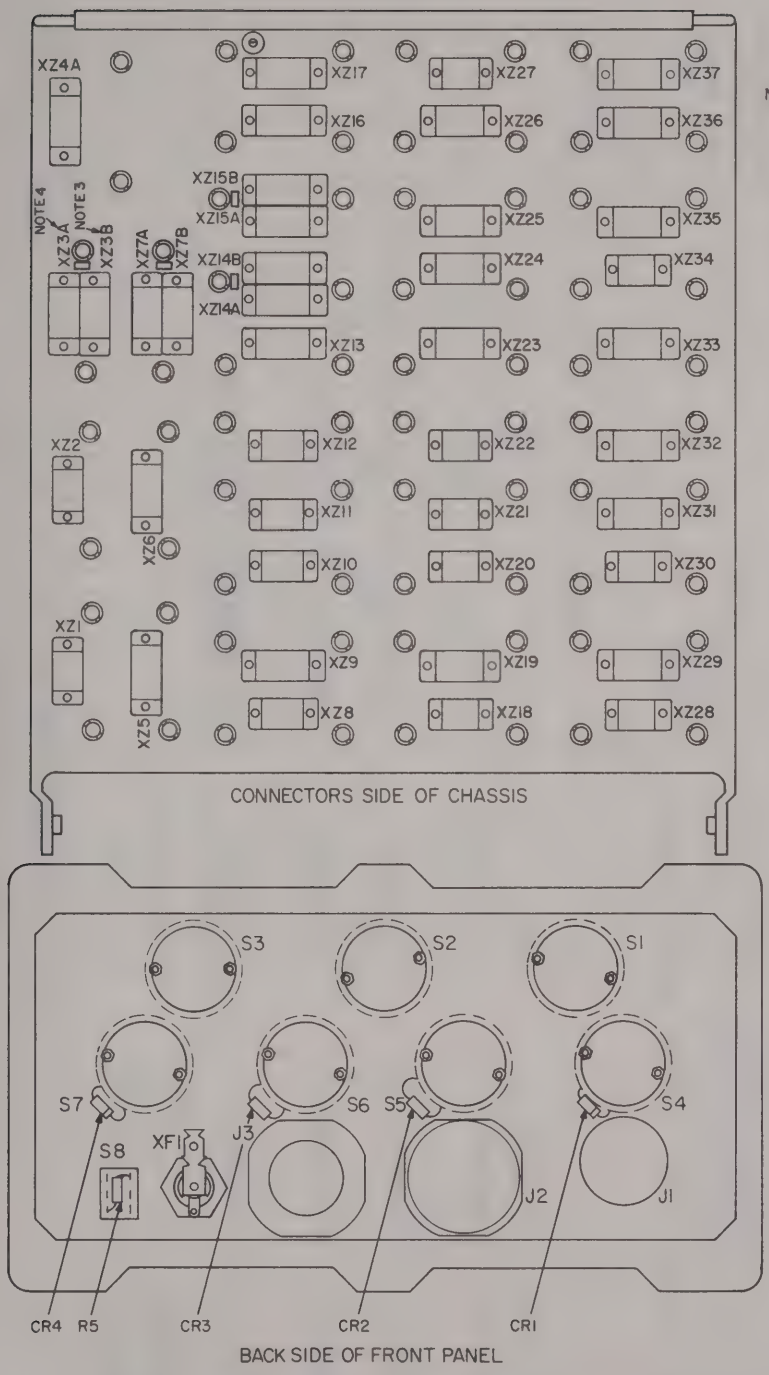
(2) LOCALIZING TROUBLE. By applying the observations of the trouble to the category and subdivision given in the table, the defect is localized to the possible cause of the trouble. Where more than one possible cause is noted in the table at the intersection of category and subdivision, they are listed in the order of greatest possible cause to least possible cause of the trouble.

(a) The locations of troubles are classed into five categories of trouble observation in the terminal set. These trouble categories are:

I	Combined transmit and receive
II	Transmit
III	Receive
IV	Signaling, transmit or receive
V	Alarm

(b) Each category is subdivided into channels affected by the trouble. These subdivisions are:

1	All channels
2	All telephone channels
3	Telephone channel 1
4	Telephone channel 2
5	Telephone channel 3
6	Telephone channel 4
7	All telegraph channels



NOTES

1. WIRING HARNESS IS NOT SHOWN FOR CLARITY.
2. THE "X" PREFIX OF NETWORKS "Z" NUMBERS INDICATE CONNECTORS AND LOCATIONS OF THE NETWORKS.
3. TELEGRAPH NETWORKS Z3, Z7, Z14 AND Z15 WHEN ARRANGED FOR TH-85/GCC OPERATION PLUG INTO XZ3B, XZ7B, XZ14B AND XZ15B CONNECTORS. THE LETTER "N" IS VISIBLE THROUGH HOLE IN CHASSIS.
4. TELEGRAPH NETWORKS Z3, Z7, Z14 AND Z15 WHEN ARRANGED FOR TH-5/TG OR TH-22/TG OPERATION PLUG INTO XZ3A, XZ7A, XZ14A, AND XZ15A CONNECTORS. THE FIGURE "5" IS VISIBLE THROUGH HOLE IN CHASSIS.

TM-07277A-12-3-2

Figure 3-2. Terminal, Telegraph-Telephone, TH-81/GCC, Parts Location

TABLE 3-3

TROUBLESHOOTING

SUB-DIVISION	TROUBLE OBSERVATION	I TRANSMIT AND RECEIVE	II TRANSMIT	III RECEIVE	IV SIGNALING		V ALARM
					XMT	REC	
1	All Chans	Fuses, power source Notes 1, 2, 5 & 6, Radio set, Z26, Z27, Z24, Z25	Notes 4, 5 & 6 Xmtr antenna, Transmitter, Z32	Notes 5 & 6, Rcvr Antenna, Receiver, Z36,,Z37	—	—	Local rcvr vol cont too low. Distant xmtr, Local mux, Note 3, Z33, Z35, Z36.
2	All Tel Chans	Z25, Z24	—	—	Z33	Z4	—
3	Tel Chan 1	TB 2W, Z25	TB 4WTR Z10, Z5, Z1	TB 4WREC, Z10 Z6, Z5, Z2	Z6, Z10 Z5	Z5, Z6, Z4	—
4	Tel Chan 2	TB 2W, Z25	TB 4WTR, Z11, Z9, Z8	TB 4WREC, Z11, Z13, Z9, Z12	Z13, Z11 Z9	Z9, Z13, Z4	—
5	Tel Chan 3	TB 2W, Z25	TB 4WTR, Z20, Z19, Z18	TB 4WREC, Z20, Z23, Z19, Z22	Z23, Z20 Z19	Z19, Z23, Z4	—
6	Tel Chan 4	TB 2W, Z25	TB 4WTR, Z21, Z29, Z28	TB 4WREC, Z21, Z31, Z29, Z30	Z31, Z21, Z29	Z29, Z31, Z4	—
7	All Tlg Chans	Z24, Z25	Z16	Z17	—	—	—
8	Tlg Chan 1	TB, Z3, Z25 Z16	Z3, Z16	Z3, Z17	—	—	—

TABLE 3-3 (Continued)

TROUBLESHOOTING

SUB-DIVISION	TROUBLE OBSERVATION	I TRANSMIT AND RECEIVE	II TRANSMIT	III RECEIVE	IV SIGNALING		V ALARM
					XMT	REC	
9	Tlg Chan 2	TB, Z7, Z25 Z16	Z7, Z16	Z7, Z17	–	–	–
10	Tlg Chan 3	TB, Z14, Z25 Z16	Z14, Z16	Z14, Z17	–	–	–
11	Tlg Chan 4	TB, Z15, Z25 Z16	Z15, Z16	Z15, Z17	–	–	–
12	Order-wire Channel	Handset cord or connector	Hndst xmtr Z34	Hndst rcvr Z35	Hndst sw or cord, Z33	Z33, Z35	Z33

NOTES

1. Check all switch settings, cables for damage, and secure connections.

2. a. Power failure from BATT or BB451, Z49 in Control C-7673/PCC.
   b. Power failure from 115 VAC, Z50 in control unit.

3. The alarm is intended to indicate lack of received signal from distant terminal. In case the alarm does not sound when signals are not received, modules are noted for correction.

4. Transmit defects will normally be reported by distant operator. Local monitor checks local user transmit connections. Local test is required to check local channel's transmit condition.

5. Set mux to a test condition and blow into the handset microphone; a loud sound heard in the handset receiver will prove that trouble is not in the mux but is in the radio.

6. When radio transmitter or receiver is cause of trouble, set MODE switch of control unit to the alternate MULTI-CHAN RT ( ) setting to interchange the radio channel frequencies with the distant terminal set to maintain communications.

8 Telegraph channel 1

9 Telegraph channel 2

10 Telegraph channel 3

11 Telegraph channel 4

12 Order-wire channel

(c) For example, from observation and monitoring it is found that the local user of telephone channel 3 is not receiving ringing signals. Ringing signals constitute category IV in table 3-3, and telephone channel 3 constitutes subdivision 5. At the intersection of category IV and subdivision 5, Z19, Z23 and Z4 are noted. Refer to figure 3-2 for parts location, and substitute a new network Z19 module first. If trouble is not corrected, replace the Z19 which was removed and proceed to substitute a new network Z23 to correct the trouble. It is least likely that Z4 will be the cause of the trouble.

(d) When trouble in the multiplex or control unit is not corrected by replacement of the noted modules, replace the unit.

g. REPAIR PROCEDURES. Repair procedures to be performed by the organizational maintenance technician are provided under this paragraph. When trouble is found to be in the multiplex or control unit, repair is made by network module replacement only. If a unit requires the attention of a higher echelon, tag the defective unit with a clear, brief description of the trouble observed and the action already taken.

(1) OPENING A UNIT

(a) Terminal, Telegraph-Telephone, TH-81/GCC, must be removed from its mount by unscrewing the two large slotted hexagonal-head screws at the bottom of the front panel. After releasing the screws, pull the unit forward to

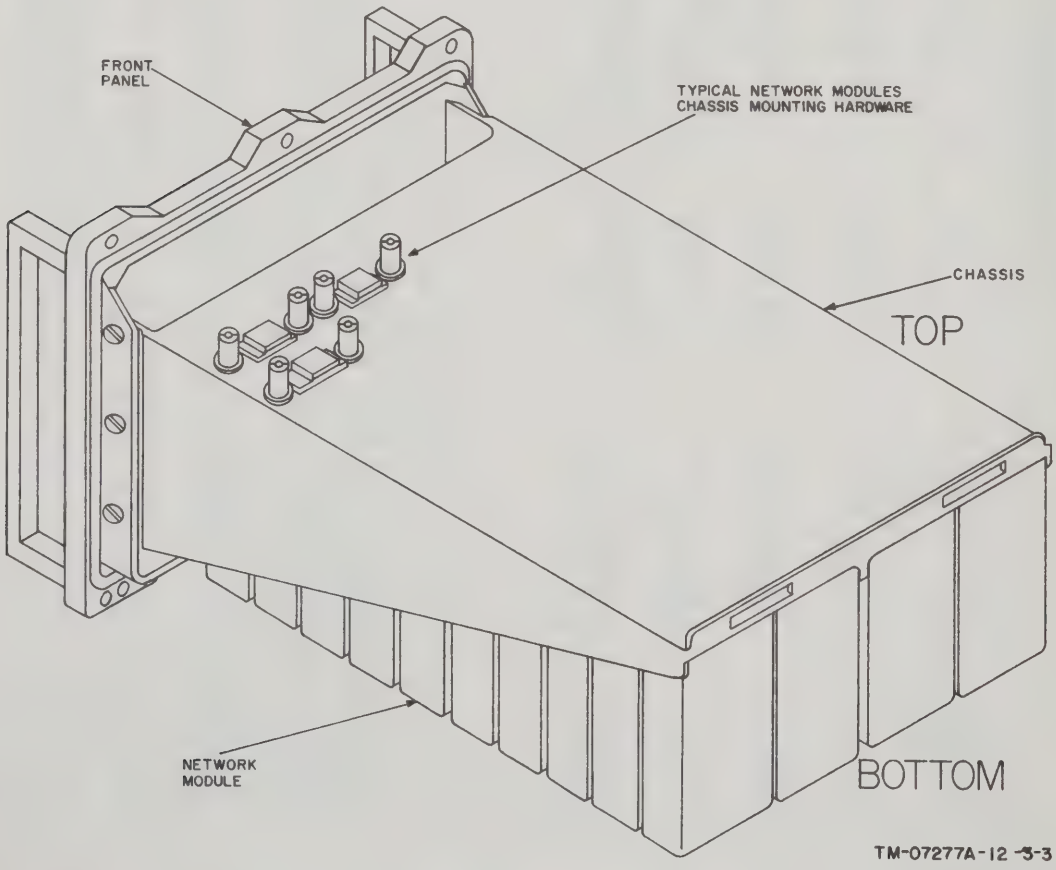


Figure 3-3. Terminal, Telegraph-Telephone, TH-81/GCC, Removed From Case

disengage T lugs from mounting base slots. Place the unit, front panel up, on a solid flat surface and remove the six slotted round screws to release the back cover from the front panel. Place the unit flat as removed from its mounting base and, making a straight strong pull, slide cover back off the chassis away from the front panel. (See figure 3-3.)

(b) Control Unit-Rectifier, C-7673/PCC-1: set POWER switch to OFF and remove power source connection. The unit is opened by removing the six screws holding the top cover in place. The modules are mounted on a bracket held by two screws (figure 3-4). Remove the two screws to release the bracket and modules. The slotted round nuts securing the modules are now accessible for removal.

(2) HANDLING PRECAUTIONS. When units are open and unprotected, keep the work area clean and clear of tools or other objects which may cause shorts or damage to the modules and wiring terminals. It is important to observe this precaution to prevent damage which could cause additional troubles.

(3) REPAIR BY NETWORK SUBSTITUTION. Proceed to locate the defective network indicated by table 3-3 and figure 3-2. Remove the two slotted round nuts and washers which secure the module (figure 3-3). Raise the chassis slightly and press the studs from which the nuts were removed to release the module from its connector. Replace the module with a replacement network module having the same Z number as that marked on the chassis next to the module connector receptacle. Restore power and test for correction of the trouble. If trouble is not corrected, remove the replacement module; replace and secure the original module with lockwashers and nuts before proceeding to the next module noted in table 3-3. Repeat the procedure with the next and following modules until trouble is cleared. If, after all modules noted for the trouble have been substituted and all returned to the original condition, the trouble has not been corrected, submit the unit to a higher echelon

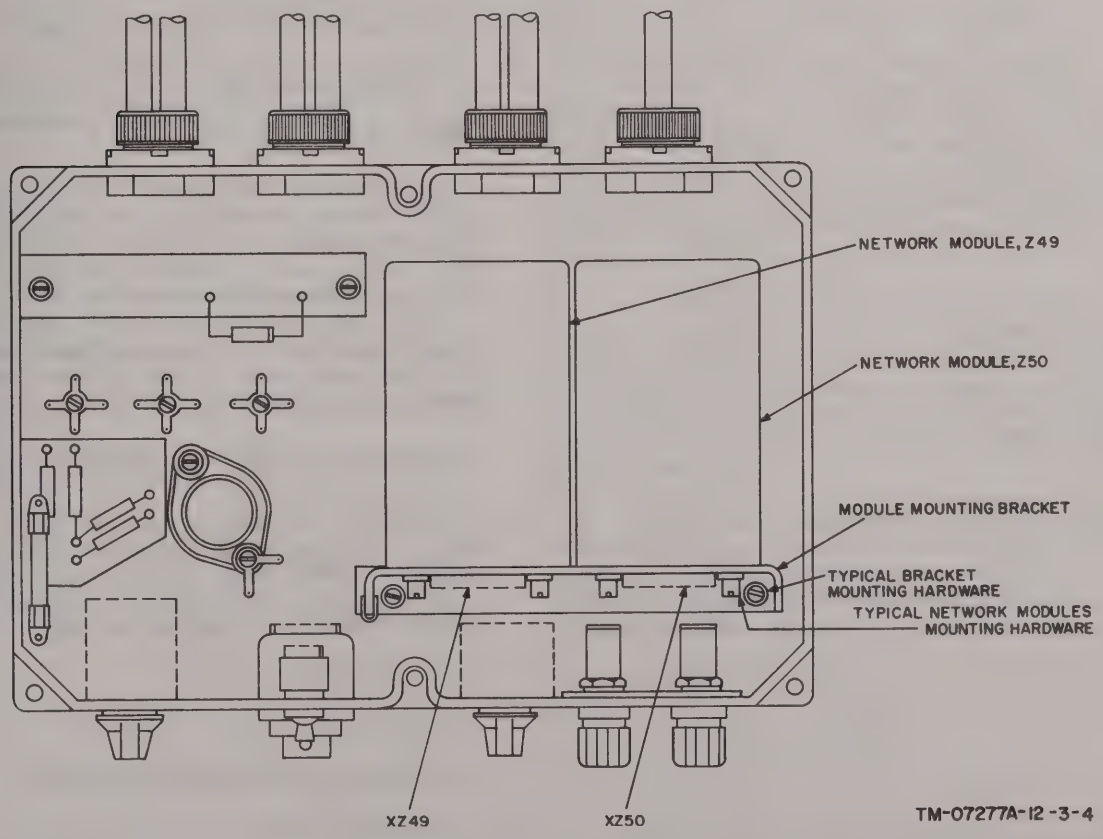


Figure 3-4. Control Unit-Rectifier, C-7673/PCC-1, Parts Location

TABLE 3-4

MODULE IDENTIFICATION

ITEM	MODULE	NETWORK DESCRIPTION
1	Z1	Tel Chan 1 xmt filter and modulator
2	Z2	Tel Chan 1 rec filter and demodulator
3	Z3	Tlg Chan 1 xmt and rec
4	Z4A	20 Hz supply
5	Z5	Tel Chan 1 hybrid
6	Z6	Tel Chan 1 rec ampl
7	Z7	Tlg Chan 2 xmt and rec
8	Z8	Tel Chan 2 xmt filter and modulator
9	Z9	Tel Chan 2 hybrid
10	Z10, Z11, Z20, Z21	Tel Chans 1, 2, 3 and 4 compandors
11	Z12	Tel Chan 2 rec filter and demodulator
12	Z13	Tel Chan 2 rec ampl
13	Z14	Tlg Chan 3 xmt and rec
14	Z15	Tlg Chan 4 xmt and rec
15	Z16	Tlg group xmt
16	Z17	Tlg group rec and demodulators
17	Z18	Tel Chan 3 xmt filter and modulator
18	Z19	Tel Chan 3 hybrid
19	Z22	Tel Chan 3 rec filter and demodulator
20	Z23	Tel Chan 3 rec ampl
21	Z24	Carrier supply
22	Z25	Carrier filter
23	Z26	Power supply A
24	Z27	Power supply B
25	Z28	Tel Chan 4 xmt filter and modulator
26	Z29	Tel Chan 4 hybrid

TABLE 3-4 (Continued)

MODULE IDENTIFICATION

ITEM	MODULE	NETWORK DESCRIPTION
27	Z30	Tel Chan 4 rec filter and demodulator
28	Z31	Tel Chan 4 rec ampl
29	Z32	Group xmt ampl
30	Z33	1600 Hz osc and alarm
31	Z34	OW xmt ampl and filter
32	Z35	OW rec ampl and alarm
33	Z36	Group rec ampl and regulator
34	Z37	Line hybrid and crystal CONTROL UNIT-RECTIFIER, C-7673/PCC-1
35	Z49	AC power supply
36	Z50	DC divider and regulator

for repair. Note that replacement modules are exactly interchangeable with the original and no adjustments are required to any part of the unit.

(4) OPERATING CHECK. After trouble has been corrected, perform an operating check by the multiplex local test procedure outlined in paragraph 3-2d. Replace the case on the chassis according to paragraph 3-3g(5) and perform the multiplex local test procedure a second time. Reestablish multiplex communications to the distant station and perform a monitoring test of all channels to prove that all trouble is eliminated.

(5) CLOSING AND REINSTALLATION

(a) Terminal, Telegraph-Telephone, TH-81/GCC: Ensure that module nuts are tightened before replacing the back cover. Slide the back cover onto the chassis toward the front cover. Engage and tighten the six round slotted screws to secure the case to the front panel. When tightening the six screws, apply an even torque to each screw in turn to draw the case evenly to the rubber seal at the back of the front panel. Replace the unit onto its mounting base, engaging the T lugs into the base slots, and securely tighten the two slotted hexagonal-head screws.

(b) Control Unit-Rectifier, C-7673/PCC-1, is closed after checking that module nuts are tightened. Replace the module bracket and secure it in place with its two screws. Replace the cover and six screws; apply equal torque to each screw in turn to draw the cover down evenly on its rubber seal.

(6) NETWORK MODULES DESCRIPTION. For the purpose of identification of the network modules, table 3-4 provides a list of module numbers, together with the functional descriptions of the networks.

APPENDIX A

GLOSSARY OF TERMS

TERM	ABBREVIATION	EXPLANATION
Attenuation	—	Signal loss; usually expressed as dB below a stated level.
Band pass filter	BP FILT	An electrical network which will pass a specified range of frequencies and rejects passage of frequencies outside of the specified frequency range.
Channel	CHAN	One message, transmit and receive path.
Compandor	—	A contraction of the words "compressor" and "expandor," each of which is an electrical circuit. The two circuits are used together in a telephone system to reduce transmission noise.
Decibel	dB	A term used to express the ratio of two power levels. The ratio in dB may be a gain or loss of the original power.
Duplex	DX	A type of operation in which simultaneous two-way conversation messages or information may be passed between any two or more points.
Half duplex	HDX	A circuit designed for duplex operation but, due to the nature of the terminal equipments, permits transmission of signals in either direction alternately but not simultaneously.
High frequency	HF	In this text only, HF designates the higher frequencies produced by the multiplex and does not refer to radio frequencies.
Hybrid	—	An electrical circuit which connects a two-wire line having transmit and receive signals to a four-wire line consisting of a transmit pair and a receive pair.
Insertion loss	—	The ratio of power, before insertion, to the power, after insertion, of a component in a transmission line. The loss is expressed in dB.
Level	—	The term used to describe the level of power in a circuit.
Line	—	The line between terminal sets including the radio circuits.
Loop	—	A single message, two-wire circuit to an end instrument.

TERM	ABBREVIATION	EXPLANATION
Mode	—	The arrangement of equipment for use.
Monitor	MON	To listen or talk on channels.
Multiplex	MUX	Designates a system of transmission in which a number of messages can be sent simultaneously in both directions on the same line or radio.
Order-wire channel	OW	The channel used by the operators of a multiplex system.
Pilot	—	The signal having a reference frequency and level which is transmitted and used by the receiving station to maintain constant signal level and frequency synchronization in a multiplex system.
Ringing	—	The term used for signaling on a telephone channel to a distant user.
Sidetone	—	The sound heard in a handset receiver which originates in the same handset transmitter.
Simplex	SX	The type of operation which permits transmission of signals in either direction alternately but not simultaneously.
System	—	The term is used in this text to describe two terminal sets operating together as a system. A repeater station, if used, would be part of the system.
Telegraph channel	TLG CHAN	A channel in a multiplex system which carries telegraph voice frequencies.
Telephone or data channel	TEL CHAN	A channel in a multiplex system which carries telephone voice frequencies or data having frequencies in the telephone frequency range.
Voice frequency	VF	The range of frequencies to which a telephone set will respond.
Two-wire	2W	A circuit consisting of two wires in which signals are transmitted and received simultaneously with a hybrid circuit separating the transmit and receive circuits of the channel.
Four-wire	4W	A circuit consisting of four wires. One pair is used for transmitting and one pair is used for receiving when the user equipment is operating four-wire.

TERM	ABBREVIATION	EXPLANATION
Four-wire transmit	4W TR	The term denotes the two wires used to connect to the transmit circuit when the user and channel are operating in a four-wire mode.
Four-wire receive	4W REC	The term denotes the two wires used to connect from the multiplex channel receiving circuit when the user and channel are operating in a four-wire mode.
Four-wire no compandor	4WNC	The term denotes that the channel operates in a four-wire mode without compandors.

APPENDIX B

ANTENNA SITING

B-1. GENERAL. Proper location of antennas is important to produce strong radio signals and reduce noise and fading. A poor site will also decrease transmission distance. Primary consideration should be given to the location of the receiving antenna. The choice of location of antennas will depend on the local terrain, the terrain between the radio set sites, and the tactical situation. Good sites are locations where antennas are free of manmade interference. They should also be high and clear of signal obstructions and absorbers, such as hills, dense woods, and buildings. Poor sites are locations in valleys, depressions, wooded areas and places adjacent to large metal structures where signals are confined and absorbed.

B-2. RADIO SIGNALS. Radio signals in the frequency range of 30 to 76 megahertz differ from transmission at higher frequencies by being able to bend somewhat around obstructions and through the atmosphere. Objects between the radio transmitting and receiving sites will absorb and weaken these radio signals. For a given situation of a receiving antenna behind a hill, the signal strength decreases with an increase of radio frequency. Transmitted radio signals must be kept strong by keeping connecting cables as short as possible and by preventing absorption into the receiving antenna.

B-3. COAXIAL CABLE LOSSES. Power is lost in coaxial cable connecting radio sets to antennas. Power losses in RG-58/U cable reduce the power through 100 feet of cable to one half of input power at 30 megahertz, and one third input power at 76 megahertz. One hundred feet of RG-8A/U Cable reduces power to four fifths and two thirds of input power at 30 and 76 megahertz, respectively. Locate the transmitter close to the antennas and make the cable as short as possible. Use RG-8A/U Cable in preference to RG-58/U Cable.

B-4. ANTENNA POSITIONING. When a receiving antenna is placed close to a transmitting antenna, effective transmitted power is decreased due to absorption of power by the receiving antenna. More importantly, the sensitivity of the receiver to the wanted signal may be greatly reduced. Locate the antennas on a line 90 degrees to the direction of the distant station and with a minimum distance of 33 feet (10 meters) between the antennas. The 33-foot minimum separation is the longest wavelength of radio signal in the 30 to 76 megahertz frequency range. The lowest frequency has the longest wavelength. A simple calculation to obtain wavelength in feet is to divide 975 by the frequency in megahertz. In the 30 to 76 megahertz range of frequencies, the longest wavelength used would be 975 divided by 30, equaling 32.5 feet. The wavelength of 76 megahertz is 12.85 feet. Where, due to terrain restrictions, it is not possible to locate the receive and transmit antennas on a line 90 degrees to the direction of the distant station, keep the antennas in line, even if this line is not at 90 degrees to direction to far station.

B-5. CHOOSING A SITE

a. FLAT TERRAIN. When siting antennas on open flat country, take advantage of any high ground or elevated locations to raise the antennas as high as possible above the surrounding terrain.

b. OPEN WATER. When siting antennas near open water, locate the antennas to radiate out over the water toward the distant station.

c. WOODED TERRAIN. Antennas located in wooded areas elevated above the top of trees give better results than if below tree-top level. A large clearing with the antennas erected on the far side of the clearing from the distant station will improve transmission. If possible, locate the antennas on a slope or hill clear of trees and facing out toward the distant station. (See figures B-1 and B-2.)

d. HILLY TERRAIN. Locate antennas on the forward side of hills facing the direction of the distant station. Choose a site where the most direct view to the distant station can be obtained. Use river channels or valleys, wherever possible, as a means of obtaining the most direct path of transmission. (See figure B-3.)

e. CONGESTED AREAS. When a site of operation is to be in an area having manmade structures, locate the antennas away from power lines, fences, bridges or other large metallic masses.

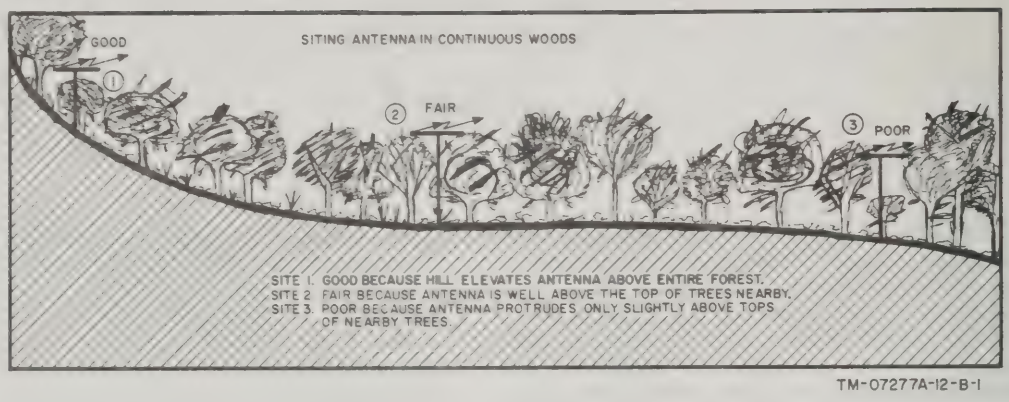


Figure B-1. VHF Antenna Siting in Dense Woods

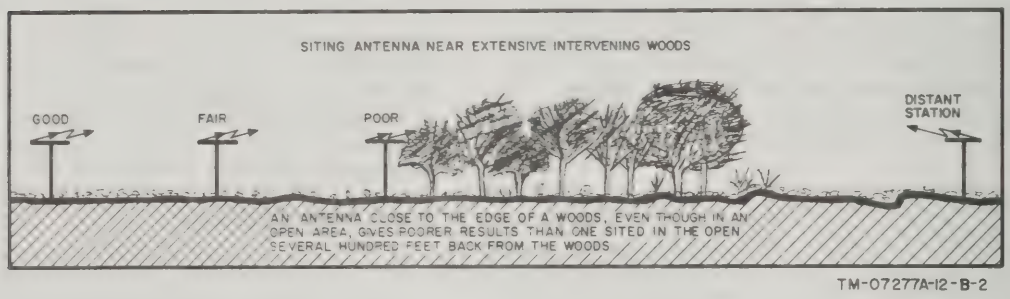


Figure B-2. VHF Antenna Siting Near Woods

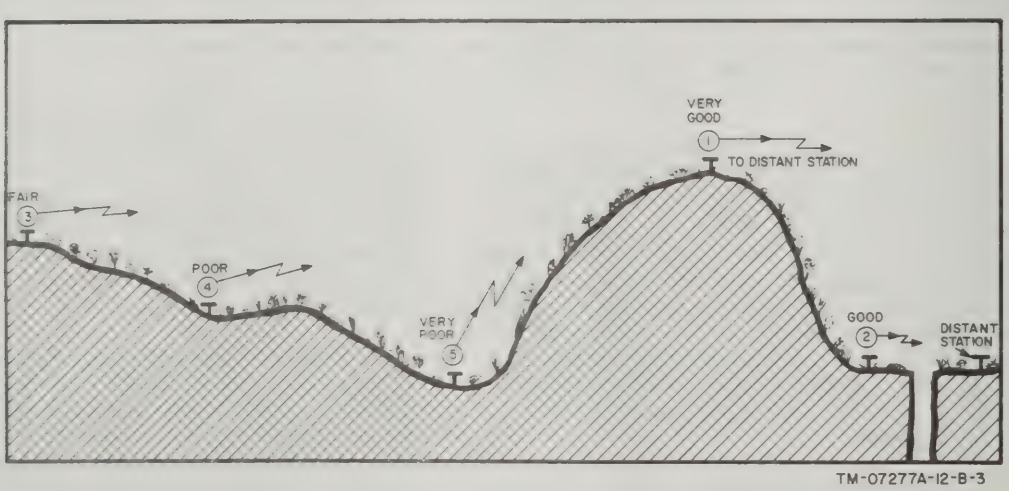


Figure B-3. VHF Antenna Siting in Hilly Terrain

Locate antennas so that the direction to the distant station is clear of obstructions.

B-6. MISCELLANEOUS TRANSMISSION CONSIDERATIONS

a. ENEMY INTERCEPTION OF SIGNALS. Radio signals are subject to enemy interception. In order to reduce this possibility, when transmitted signals produce a strong received signal, reduce the transmitting antenna height and reduce transmitting power if possible. Locate the antenna so that transmission in the direction of the enemy is blocked by hills or trees. Directional antennas give a greater degree of signal security by reducing the transmitted signal in directions other than toward the intended receiver.

b. NOISE AND INTERFERENCE. Large amounts of radio noise can reduce intelligibility of received signals and cause errors in superimposed teletypewriter signals. Common sources of noise are motor ignition systems, local electrical circuits and radio transmitters. Interference may also be caused by teletypewriters and cipher machines. Physical separation of the noise from the radio receiver antennas is required. If radio sets are not in good operating condition, or antennas are improperly located and adjusted, noise will be stronger.

c. MUTUAL RADIO INTERFERENCE. Interfering signals may be encountered where radio sets are operated near other radio sets. Choose transmitting and receiving frequencies to prevent interaction with signals of nearby radio sets. Noninterfering frequencies may be chosen from charts published in the technical manual for the radio set to be used.

APPENDIX C

MAINTENANCE ALLOCATION CHART

SECTION I

INTRODUCTION

C-1. GENERAL

a. This Section provides a general explanation of all maintenance and repair functions authorized at various maintenance levels.

b. Section II designates overall responsibility for the performance of maintenance functions on the identified end item or components.

c. Section III lists the special tools and test equipment required for each maintenance function as referenced from section II. Special tools are defined as those tools, designated and developed specifically for use with the end item or components, that are necessary for servicing, testing, adjusting and maintenance.

d. Section IV contains supplemental instructions, explanatory notes and/or illustrations required for a particular maintenance function as referenced from section II.

C-2. EXPLANATION OF COLUMNS IN SECTION II

a. Index Number (Column 1). This number is assigned for referencing purposes.

b. End Item/Component (Column 2). This column contains a brief description of the end item or component.

c. Maintenance Functions (Column 3). This column lists the various maintenance functions (A through K) and indicates the lowest maintenance category authorized to perform these functions. The symbol designations for the various maintenance categories are as follows:

1 – 1st Echelon - Operator or Crew	Organizational Maintenance
2 – 2nd Echelon - Repairman/ Technician	
3 – 3rd Echelon	Field Maintenance
4 – 4th Echelon	
5 – 5th Echelon - Depot Maintenance	

The maintenance functions are defined as follows:

A – INSPECT. To determine serviceability of an item by comparing its physical, mechanical, and electrical characteristics with established standards.

B – TEST. To verify serviceability and to detect electrical or mechanical failure by use of test equipment.

C – SERVICE. To clean, preserve, charge, paint, and add fuel, lubricants, cooling agents, and air.

D – ADJUST. To rectify to the extent necessary to bring into proper operating range.

E – ALIGN. To adjust specified variable elements of an item to bring it to optimum performance.

F – CALIBRATE. To determine the corrections to be made in the readings of instruments or test equipment used in precise measurement. Consists of the comparisons of two instruments, one of which is a certified standard of known accuracy, to detect and adjust any discrepancy in the accuracy of the instrument being compared with the certified standard.

G – INSTALL. To set up for use in an operational environment, such as an emplacement, site, or vehicle.

H – REPLACE. To replace unserviceable items with serviceable assemblies, subassemblies, or parts.

I – REPAIR. To restore an item to serviceable condition. This includes, but is not limited to, inspection, cleaning, preserving,

adjusting, replacing, welding, riveting, and strengthening.

J – OVERHAUL. To restore an item to a completely serviceable condition, as prescribed by maintenance serviceability standards, by inspecting and repairing as necessary.

K – REBUILD. To restore an item to a standard as nearly as possible to original or new condition in appearance, performance, and life expectancy. This is accomplished through complete disassembly of the item; inspection of all parts or components; repair or replacement of worn or unserviceable elements (items), using original manufacturing tolerances and specifications; and subsequent reassembly of the item.

d. Tools and Equipment (Column 4). This column is provided for referencing, by code, the special tools and test equipment (section III) required to perform the maintenance functions (section II).

e. Remarks (Column 5). This column is provided for referencing the remarks (section IV) pertinent to the maintenance functions.

C-3. EXPLANATION OF COLUMNS IN SECTION III

a. Reference Code. This column refers to the note number contained in column 4 of maintenance allocation chart.

b. Maintenance Functions. This column contains the maintenance functions (from column 3 of the maintenance allocation chart) that require the special tool or test equipment.

c. Maintenance Category. This column shows the lowest level of maintenance authorized to use the special tool or test equipment.

d. Nomenclature. This column lists the name or identification of the tool or test equipment.

e. Tool Number. This column lists the manufacturer's code and part numbers, or Federal stock numbers of tools and test equipment.

C-4. EXPLANATION OF COLUMNS IN SECTION IV

a. Reference Code. This column refers to the note number contained in column 5 of the maintenance allocation chart.

b. Maintenance Functions. This column contains the maintenance functions (taken from column 3 of the maintenance allocation chart) that call out remarks.

c. Remarks. This column lists information pertinent to the maintenance functions being performed, as indicated on the maintenance allocation chart, section II.

SECTION II

MAINTENANCE ALLOCATION CHART

(1) Index No.	(2) End Item/Component	(3) Maintenance Functions (Sect I, C-2)											(4) Tools & Equipment (Sect III)	(5) Remarks (Sect IV)
		A	B	C	D	E	F	G	H	I	J	K		
		Inspect	Test	Service	Adjust	Align	Calibrate	Install	Replace	Repair	Overhaul	Rebuild		
01	Radio Term Set, AN/TRC-166	1	3	1	3	-	-	1	1	2	4	-	Code 1	-
02	Radio Set, AN/PRC-25	1	-	-	-	-	-	-	-	-	-	-	-	Note 1
03	Radio Set, AN/PRC-77	1	-	-	-	-	-	-	-	-	-	-	-	Note 2
04	Terminal Set, AN/PCC-1	1	3	1	3	-	-	1	2	2	4	-	Code 1	-
05	Terminal, TH-81/GCC	1	3	1	3	-	-	1	2	2	4	-	Code 1	-
06	Control, C-7673/PCC	1	3	1	3	-	-	1	2	2	4	-	Code 1	-
07	Terminal Box, J-2790/GCC	1	2	1	-	-	-	1	1	2	4	-	-	-
08	Cable, CG-1773A/U	1	2	1	-	-	-	1	1	3	-	-	-	-
09	Cable, CX-10913/GCC	1	2	1	-	-	-	1	1	3	-	-	-	-
10	Cable, CX-10914/GCC	1	2	1	-	-	-	1	1	3	-	-	-	-
11	Cable, CX-12756/G	1	2	1	-	-	-	1	1	3	-	-	-	-
12	Cover, CW-996/PCC-1	1	-	1	-	-	-	1	1	4	-	-	-	-
13	Cover, CW-1024/PCC-1	1	-	1	-	-	-	1	1	4	-	-	-	-
14	Cover, CW-1030/PCC-1	1	-	1	-	-	-	1	1	4	-	-	-	-
15	Cover, TB F60773	1	-	1	-	-	-	1	1	4	-	-	-	-
16	Mount, MT-4056/PCC-1	1	-	1	-	-	-	1	1	3	-	-	-	-
17	Mount, MT-4057/PCC-1	1	-	1	-	-	-	1	1	3	-	-	-	-
18	Support, AB-1135/PRC	1	2	1	-	-	-	1	1	3	-	-	-	-
19	Adapter, UG-255A/U	1	-	1	-	-	-	1	1	-	-	-	-	-

SECTION III

SPECIAL TOOLS AND TEST EQUIPMENT REQUIREMENTS

REFERENCE CODE	MAINTENANCE FUNCTIONS	MAINTENANCE CATEGORY	NOMENCLATURE	TOOL NUMBER
1	Test, adjust and repair	3	Test Kit	Part No. F64882 Mfg. Code 96344

SECTION IV

REMARKS

REFERENCE CODE	MAINTENANCE FUNCTION	REMARKS
Note 1	—	All maintenance will be in accordance with TM 11-5820-398-12 and TM 11-5820-398-35.
Note 2	—	All maintenance will be in accordance with TM 11-5820-667-12 and TM 11-5820-667-35.

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U.S. MARINE CORPS

AN/PCC-1 Terminal Set, Telegraph-Telephone

ASSEMBLY INSTRUCTIONS

1. Take F59573 Plate from the installation Kit and insert it inside the leather top on the rucksack frame with the two screws extending through the existing holes in the leather per figure 1.

FIG. 1

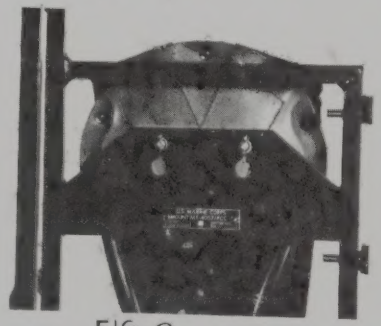

FIG. 2

2. Put Mount MT-4056/PCC-1 or Mount MT-4057/PCC-1 on the rucksack frame with the two slots of the mount over the screws of the rucksack frame. Install and tighten the two wing nuts see figure 2. Install clamps at the base of the frame per figure 3 for MT-4057/PCC-1 and per figure 4 for MT-4057/PCC-1.

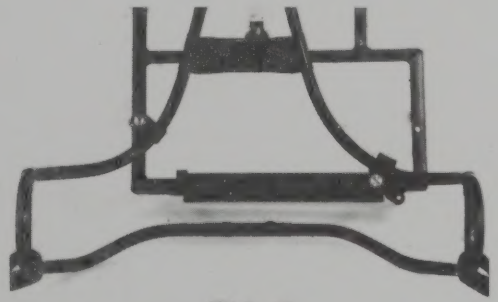

FIG. 3

3. Mount the base of Terminal Box J-2790/GCC on MT-4056/PCC-1 on the rear of the lower bar with the clamp at the left side of the bearer per figure 5.

4. To mount the control unit per figure 6 fasten the two brackets (from the installation kit) to the control unit. Then remove the four screws holding the panel and case of one of the receiver-transmitters (this will become RT 2). Put the control unit over the receiver-transmitter with the two brackets behind the extensions of the case. Insert and tighten the four panel screws.

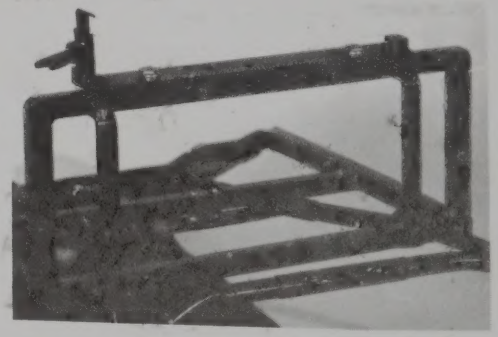

FIG. 5

5. Put cover, Battery CW-996/PCC-1 on Battery BB-451/U and using the clamp provided on the cover install on the mount as indicated on the mount.

6. Install receiver-transmitters and terminal TH-81/GCC on the mounts as indicated on the mounts.

7. Install Cover, Protective CW-10241/PCC-1 over the radio sets and control unit and Cover, Protective CW-1030/PCC-1 over the carrier terminal and battery per figure 7.

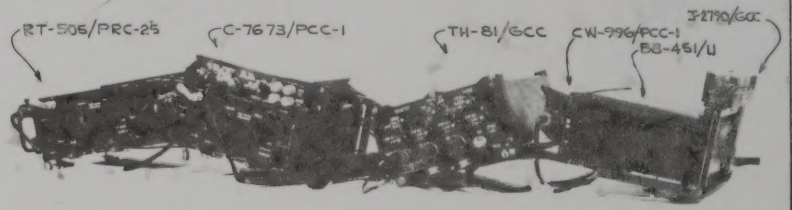

FIG. 6

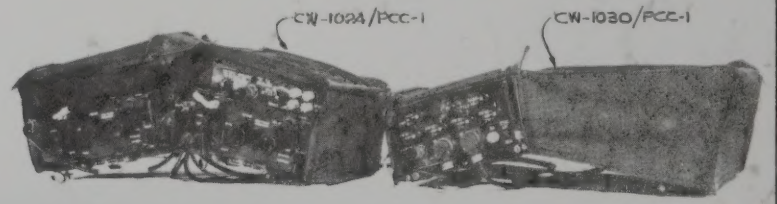

FIG. 7